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DIGITAL RISK GOVERNANCE AND SUSTAINABILITY IN SMES: EVIDENCE FROM NORTH MACEDONIA

Elizabeta Mitreva
Faculty of Tourism and Business Logistics, Goce Delcev University, Stip, North Macedonia
Mail: elizabeta.mitreva@ugd.edu.mk

Abstract

Small and medium-sized enterprises (SMEs) represent the backbone of the economy in North Macedonia, yet they increasingly operate in an environment characterized by rapid digitalization and increasing sustainability pressures. This study examines the relationship between digital risk governance maturity and sustainable performance among SMEs in North Macedonia. Specifically, the research investigates how organizational and institutional factors influence the development of digital risk governance and how this capability contributes to environmental, social, and governance (ESG) outcomes.
A quantitative research design was employed based on survey data collected from 150 SMEs in North Macedonia. The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM).

The results indicate that digital literacy, formalized digital policies, organizational capacity, export exposure, and institutional pressures significantly influence the maturity of digital risk governance. Furthermore, digital risk governance maturity has a strong positive effect on sustainable performance, confirming its role as a strategic organizational capability. Mediation analysis reveals that digital risk governance partially mediates the relationship between organizational and institutional factors and ESG outcomes.

The study contributes to the literature by integrating digital risk governance with sustainability research in the SME context of a transition economy. Practical implications highlight the importance of strengthening digital competencies, formal governance frameworks, and institutional support mechanisms in order to enhance both digital resilience and sustainable development among SMEs. Furthermore, the study confirms that digital risk governance serves as a critical mediator, effectively translating organizational resources into measurable ESG performance.

Key words: sustainability, SMEs, ESG performance, digital maturity, North Macedonia
JEL Classification: C45, C53, D81, L86

INTRODUCTION

Small and medium-sized enterprises (SMEs) represent a fundamental pillar of economic development in most economies worldwide. Within the European Union and transition economies in particular, SMEs account for the vast majority of enterprises and play a crucial role in employment generation, innovation, and regional development (European Commission, 2023). In North Macedonia, SMEs constitute more than 99% of all registered enterprises and contribute significantly to employment and value creation. Their ability to adapt to technological change and evolving market conditions is therefore critical for the overall resilience and competitiveness of the national economy.

In recent years, the rapid acceleration of digital transformation has significantly reshaped the business environment in which SMEs operate. The adoption of digital technologies such as cloud computing, data analytics, digital platforms, and artificial intelligence has created new opportunities for improving operational efficiency, customer engagement, and market expansion (Bharadwaj et al., 2013; Vial, 2019). At the same time,

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digitalization has introduced a new category of organizational risks related to cybersecurity threats, data protection issues, operational disruptions, and regulatory compliance challenges (Kraus et al., 2021). These risks are commonly referred to as digital risks and require structured governance mechanisms that enable organizations to identify, assess, and mitigate threats associated with digital operations.

Digital risk governance has therefore emerged as an essential component of modern organizational management. It encompasses the structures, policies, and processes through which organizations manage risks arising from digital technologies, information systems, and digital infrastructures (World Economic Forum, 2022). Effective digital risk governance involves not only technical security solutions but also organizational policies, leadership commitment, employee training, and continuous monitoring mechanisms. While large corporations often possess the resources and expertise necessary to implement advanced digital risk management systems, SMEs frequently face limitations related to financial resources, technological infrastructure, and specialized knowledge (Ghobakhloo & Fathi, 2021).

Simultaneously, businesses worldwide are facing increasing expectations regarding sustainable development and responsible business conduct. Sustainability has evolved from a peripheral corporate initiative into a central strategic priority for organizations across industries. The concept of sustainability in business is typically framed through the Environmental, Social, and Governance (ESG) perspective, which emphasizes the integration of environmental responsibility, social impact, and transparent governance structures into corporate strategies (Eccles & Klimenko, 2019). Investors, regulators, and consumers increasingly expect organizations to demonstrate accountability and transparency regarding their environmental and social performance.

For SMEs, integrating sustainability into business strategies presents both opportunities and challenges. On the one hand, sustainable practices can enhance reputation, improve stakeholder trust, and create long-term competitive advantages (Dangelico & Pujari, 2019). On the other hand, SMEs often face resource constraints that limit their ability to implement structured sustainability strategies. Many sustainability initiatives within SMEs remain reactive or compliance-driven rather than strategically integrated into core business operations (Revell, Stokes, & Chen, 2010).

Recent scholarly discussions suggest that digital transformation and sustainability are not independent processes but rather mutually reinforcing phenomena. Digital technologies can facilitate more efficient resource management, enable data-driven decision-making, and support environmental monitoring systems (George et al., 2021). At the same time, inadequate digital governance may expose organizations to cyber threats, operational failures, and reputational damage that undermine long-term sustainability objectives. Consequently, the integration of digital risk governance and sustainability management has emerged as an important research area within contemporary management and information systems literature. Despite the growing global interest in digital governance and sustainability, empirical research focusing on SMEs in transition economies remains relatively limited. Most existing studies have been conducted in developed markets with advanced digital infrastructures and mature regulatory environments (Kraus et al., 2021). In contrast, SMEs operating in emerging and transition economies often face different institutional contexts characterized by evolving regulatory frameworks, limited technological resources, and varying levels of digital maturity.
North Macedonia represents an illustrative example of such a transitional economic environment. The country has made significant progress in digitalization and regulatory alignment with European Union standards; however, many SMEs continue to experience

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barriers related to digital skills, cybersecurity awareness, and access to technological resources. Moreover, sustainability initiatives within the SME sector are still developing and are often influenced by regulatory requirements, international market pressures, or donor-supported programs rather than internally driven strategic priorities.

Within this context, understanding the interaction between digital risk governance and sustainability becomes particularly important. The ability of SMEs to develop structured mechanisms for managing digital risks may represent a critical organizational capability that enables them to achieve broader sustainability goals. Digital risk governance can enhance transparency, improve accountability mechanisms, and strengthen organizational resilience, thereby supporting sustainable performance outcomes.

This study therefore aims to examine the role of digital risk governance maturity in shaping sustainable performance among SMEs in North Macedonia. Specifically, the research investigates how organizational factors—such as digital literacy, formalized digital policies, and organizational capacity—and institutional factors—such as regulatory pressures and export exposure—contribute to the development of digital risk governance maturity. Furthermore, the study explores whether digital risk governance acts as a mediating mechanism through which these factors influence ESG performance.

By addressing these questions, the research contributes to several streams of literature. First, it expands the emerging body of research on digital risk governance by examining its implications for sustainability outcomes. Second, it integrates insights from the resource-based view and institutional theory to develop a comprehensive analytical framework explaining how internal capabilities and external pressures shape organizational practices. Third, it provides empirical evidence from a transition economy context, which remains underrepresented in the existing literature on digital governance and sustainable development.

From a practical perspective, the findings of this study provide valuable insights for SME managers, policymakers, and institutional stakeholders. Understanding the mechanisms through which digital governance contributes to sustainability can support the design of targeted policies, training programs, and digital transformation initiatives that strengthen the resilience and competitiveness of the SME sector.

The remainder of the paper is structured as follows. The next section reviews the relevant literature and develops the conceptual framework and research hypotheses. The third section describes the research methodology and data collection procedures. The fourth section presents the empirical results, followed by a discussion of the findings and concluding remarks.

LITERATURE REVIEW

Digital Risk Governance in SMEs

The rapid expansion of digital technologies has fundamentally transformed organizational processes, communication systems, and value creation mechanisms. Digital transformation enables firms to improve efficiency, access new markets, and enhance innovation capabilities; however, it simultaneously introduces a new spectrum of risks related to cybersecurity, data protection, operational disruptions, and regulatory compliance (Vial, 2019; Kraus et al., 2021).

Digital risk governance refers to the institutional structures, policies, and managerial practices through which organizations identify, assess, and manage risks arising from digital technologies and digital infrastructures. Unlike traditional risk management approaches, digital risk governance integrates technological, organizational, and strategic dimensions of risk

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management (World Economic Forum, 2022). It involves establishing formal policies, implementing security protocols, ensuring employee awareness, and developing continuous monitoring mechanisms.

Small and medium-sized enterprises (SMEs) face particular challenges in implementing structured digital risk governance frameworks. Due to limited financial resources, lack of specialized expertise, and constrained technological infrastructure, SMEs are often more vulnerable to digital threats than larger corporations (Ghobakhloo & Fathi, 2021). Studies show that many SMEs rely on ad hoc or reactive cybersecurity practices rather than systematic risk governance frameworks (Ahmad et al., 2020).

Nevertheless, the importance of digital risk governance has increased significantly in recent years. Cybersecurity incidents, data breaches, and disruptions of digital operations can lead not only to financial losses but also to reputational damage and loss of stakeholder trust (Kraus et al., 2021). Consequently, organizations are increasingly encouraged to adopt internationally recognized frameworks such as ISO 27001, the NIST Cybersecurity Framework, and COBIT to structure their digital risk management processes (Ahmad et al., 2020).

In addition to technological safeguards, effective digital risk governance also requires organizational learning and continuous capability development. Firms must cultivate internal competencies that allow employees and managers to recognize digital vulnerabilities, respond to incidents, and integrate risk awareness into daily operational practices. This perspective highlights the importance of human capital and organizational culture in shaping the maturity of digital governance systems.

Within SMEs, the effectiveness of digital risk governance is strongly influenced by organizational capabilities, including leadership commitment, digital literacy, and the availability of internal resources. Research suggests that human capital and digital competencies are particularly important factors in enabling SMEs to implement structured digital governance mechanisms (Ghobakhloo & Fathi, 2021). In many cases, employee awareness and training programs represent the most effective and accessible strategy for strengthening digital resilience.

Despite these developments, empirical evidence indicates that SMEs in emerging and transition economies still face significant barriers in developing mature digital risk governance systems. Institutional environments, regulatory frameworks, and access to technological resources play a crucial role in shaping the digital maturity of organizations (Kraus et al., 2021). As a result, understanding the interaction between internal organizational factors and external institutional pressures becomes essential when analyzing digital governance practices. Such barriers include limited financial resources, lack of specialized expertise, and insufficient institutional support mechanisms.

Sustainability and ESG Practices in SMEs

Sustainability has become one of the most influential concepts in contemporary business and management research. The concept refers to the ability of organizations to balance economic performance with environmental responsibility and social impact while ensuring long-term value creation for stakeholders (Elkington, 1997). In recent years, the sustainability agenda has increasingly been framed through the Environmental, Social, and Governance (ESG) framework, which provides measurable indicators for evaluating corporate responsibility and long-term performance (Eccles & Klimenko, 2019).

For SMEs, sustainability practices can include energy efficiency initiatives, responsible waste management, ethical labor practices, community engagement, and transparent governance structures. Although sustainability has traditionally been associated with large

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multinational corporations, SMEs are increasingly expected to adopt responsible business practices due to regulatory developments, investor expectations, and evolving consumer preferences (Dangelico & Pujari, 2019).

However, implementing sustainability strategies presents particular challenges for SMEs. Limited financial resources, lack of managerial expertise, and short-term operational priorities often hinder the systematic integration of sustainability into organizational strategies (Revell et al., 2010). As a result, sustainability initiatives within SMEs frequently remain fragmented or compliance-driven rather than strategically embedded within organizational decision-making processes.

Recent research emphasizes that SMEs can nevertheless derive significant benefits from adopting sustainability practices. These benefits include improved operational efficiency, enhanced brand reputation, stronger stakeholder relationships, and increased access to international markets (George et al., 2021). In particular, companies operating in global value chains are often required to comply with sustainability standards imposed by international partners and regulatory institutions. Digital technologies increasingly play a crucial role in supporting sustainability initiatives. Tools such as digital monitoring systems, data analytics, and automated reporting platforms enable firms to track environmental indicators, optimize resource use, and enhance transparency in governance practices. As a result, digital capabilities are becoming an important enabler of ESG performance.

Within the European context, sustainability regulations and ESG reporting standards are becoming increasingly relevant for SMEs, particularly those engaged in export-oriented activities. The alignment with European sustainability frameworks encourages organizations to develop more transparent governance structures and adopt responsible business practices (European Commission, 2023). Consequently, sustainability is gradually evolving from a voluntary initiative into a strategic necessity for organizations seeking long-term competitiveness (NIST, 2023).

The Intersection of Digital Risk Governance and Sustainability

Recent academic discussions increasingly emphasize the interconnected nature of digital transformation and sustainability. Digital technologies have the potential to facilitate sustainable development by enabling more efficient resource management, data-driven decision-making, and improved transparency across organizational processes (George et al., 2021).

For example, cloud computing and digital platforms can reduce the need for physical infrastructure, thereby lowering energy consumption and environmental impact. Similarly, data analytics tools can support organizations in monitoring environmental performance, optimizing supply chains, and improving operational efficiency. These technological capabilities illustrate how digitalization can serve as an important enabler of sustainable business practices.

However, inadequate digital governance may undermine sustainability efforts. Cybersecurity breaches, data misuse, and digital system failures can damage organizational reputation, reduce stakeholder trust, and create financial and operational instability (World Economic Forum, 2022). Consequently, effective digital risk governance becomes essential for ensuring that digital transformation contributes positively to long-term sustainability objectives (Ghobakhloo, 2018).

The integration of digital risk governance and sustainability also aligns with broader theoretical perspectives in management research. From a resource-based view (RBV), digital governance capabilities represent valuable organizational resources that enable firms to develop competitive advantages (Barney, 1991). Simultaneously, institutional theory suggests that organizations adopt digital governance and sustainability practices in response to regulatory requirements, market pressures, and societal expectations (Markovic et al., 2021).

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Despite the increasing recognition of this relationship, empirical research examining the link between digital risk governance and sustainability remains limited, particularly in the context of SMEs. Most existing studies focus on digital transformation or sustainability independently, without exploring the mechanisms through which digital governance capabilities influence sustainable performance outcomes. This limitation highlights the need for integrated analytical frameworks that examine how digital governance mechanisms influence sustainability outcomes within organizations. Institutional alignment necessitates not just policy compliance but the demonstration of technical cyber resilience, which is increasingly evaluated by international partners.

Research Gap

Although the literature provides important insights into digital transformation, cybersecurity, and sustainability practices, several research gaps remain. First, the majority of existing studies focus on large corporations in developed economies, while SMEs in transition economies receive significantly less attention.

Second, limited research has explored the role of digital risk governance as a mediating mechanism between organizational and institutional factors and sustainability outcomes. Understanding this relationship is particularly important for SMEs, which must balance technological innovation with resource constraints and regulatory pressures.

Third, empirical evidence from Southeast European and Western Balkan countries remains scarce. SMEs operating in these regions face unique institutional environments characterized by evolving regulatory frameworks, limited access to technological resources, and varying levels of digital maturity.

This study addresses these gaps by examining the relationship between digital risk governance maturity and sustainable performance among SMEs in North Macedonia. By integrating organizational and institutional perspectives, the research provides new insights into how digital governance capabilities can support sustainable development in a transition economy context.

Conceptual Framework

The review of the existing literature indicates that both organizational capabilities and institutional pressures play an important role in shaping how firms respond to digital transformation and sustainability challenges. In the context of small and medium-sized enterprises, internal organizational factors such as digital literacy, formalized digital policies, and organizational capacity represent critical resources that influence the ability of firms to develop structured digital governance mechanisms. At the same time, external pressures—particularly regulatory expectations and exposure to international markets—encourage firms to adopt more formalized approaches to digital risk management and responsible business practices.

Building on the resource-based view and institutional theory, this study proposes that the maturity of digital risk governance represents a key organizational capability that links these internal and external factors with sustainable performance outcomes. Specifically, organizational resources and institutional pressures are expected to influence the development of digital risk governance structures, which in turn enhance firms' ability to achieve environmental, social, and governance (ESG) objectives.

To examine these relationships, a conceptual research model was developed that integrates organizational factors, institutional pressures, digital risk governance maturity, and sustainable performance. The proposed relationships among these constructs are illustrated in Figure 1.

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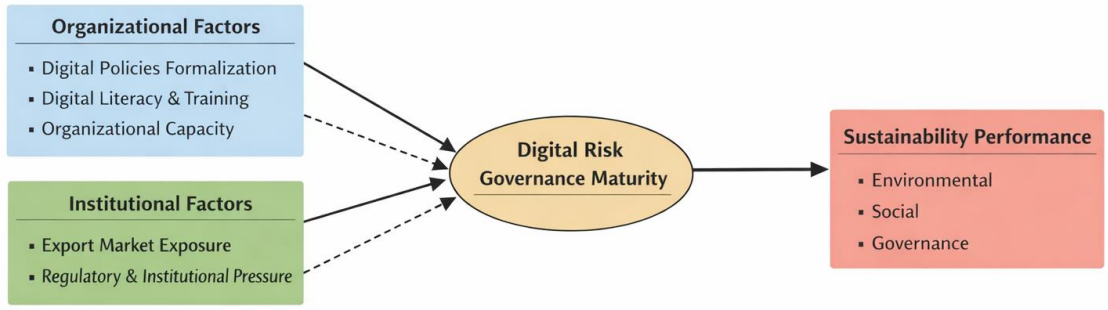
Figure 1. Conceptual model of digital risk governance and sustainable performance in SMEs



Source: Author's elaboration

Figure 1 presents the conceptual model of the study, illustrating the relationships between organizational factors, institutional pressures, digital risk governance maturity, and sustainable performance.

The model assumes that organizational capabilities and institutional pressures influence the maturity of digital risk governance, which subsequently contributes to improved sustainability outcomes. By positioning digital risk governance as an intermediary organizational capability, the model provides a structured framework for examining how SMEs translate digital transformation pressures into sustainable performance.

The model provides a basis for empirical testing using PLS-SEM, enabling the examination of both direct and mediating relationships.

Hypotheses Development

Based on the conceptual framework, this study develops a set of hypotheses that explain how organizational and institutional factors influence digital risk governance maturity and, consequently, sustainable performance in SMEs.

Organizational factors represent internal capabilities that support the development of structured digital governance practices. Firms with higher levels of digital literacy are better able to understand technological risks and implement appropriate governance mechanisms. Similarly, the existence of formal digital policies provides guidance for managing digital processes and cybersecurity risks, while organizational capacity reflects the availability of resources needed to implement governance structures.

These capabilities are consistent with the resource-based view, which emphasizes the importance of internal organizational resources and competencies as drivers of strategic capabilities and competitive advantage.

Based on the above arguments, the following hypotheses are proposed:

H1: Digital literacy positively influences digital risk governance maturity.

H2: Digital policies positively influence digital risk governance maturity.

H3: Organizational capacity positively influences digital risk governance maturity.

In addition to internal capabilities, firms are also influenced by external institutional pressures. SMEs that operate in international markets are often exposed to stricter regulatory frameworks and higher expectations regarding digital security and responsible business practices. Export exposure can therefore encourage firms to develop more advanced governance mechanisms. Likewise, institutional pressure from regulators, industry standards, and stakeholders can stimulate the adoption of structured digital risk governance practices.

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As a result, internationally active SMEs are more likely to invest in formal governance mechanisms that ensure compliance with digital security standards and sustainability requirements.

Based on these arguments, the following hypotheses are formulated:

H4: Export exposure positively influences digital risk governance maturity.

H5: Institutional pressure positively influences digital risk governance maturity.

Finally, the maturity of digital risk governance is expected to play an important role in supporting sustainable performance. Organizations that effectively manage digital risks are better positioned to implement transparent, accountable, and responsible practices that align with environmental, social, and governance (ESG) principles. A mature digital governance system enables firms to manage technological risks more effectively, enhance transparency in digital operations, and strengthen accountability mechanisms aligned with ESG principles. Digital risk governance serves as the operational filter that translates latent organizational resources into tangible ESG outcomes.

Based on these arguments, the final hypothesis is proposed:

H6: Digital risk governance maturity positively influences sustainable performance.

Together, these hypotheses define the structural relationships examined in the empirical analysis presented in the following section.

METHODOLOGY

Research Model and Variables

The research model developed in this study examines the relationships between organizational factors, institutional pressures, digital risk governance maturity, and sustainable performance in small and medium-sized enterprises (SMEs). The model builds on the conceptual framework presented earlier and tests the proposed hypotheses using empirical data collected from SMEs.

Organizational factors are represented by three constructs: digital literacy, digital policies, and organizational capacity. These variables reflect internal capabilities that enable firms to understand digital risks, implement formal governance structures, and allocate resources for managing digital transformation.

Institutional factors capture external pressures influencing organizational behavior. In this study, they are represented by export exposure and institutional pressure. Export exposure reflects the extent to which firms operate in international markets, where regulatory expectations and digital standards are typically higher. Institutional pressure represents regulatory requirements, industry expectations, and stakeholder demands that encourage firms to adopt responsible digital governance practices.

Digital risk governance maturity represents the central mediating construct in the research model. It reflects the degree to which organizations implement structured mechanisms for identifying, managing, and monitoring digital risks, including cybersecurity, data protection, and digital compliance.

This includes the organization's readiness to adopt automated risk monitoring tools and AI-driven security protocols as part of their digital infrastructure.

Finally, sustainable performance represents the outcome variable of the model. It captures the extent to which firms achieve environmental, social, and governance (ESG) outcomes as part of their business strategy and operational practices.

The relationships among these constructs are tested using structural equation modeling in order to evaluate the proposed hypotheses and assess the role of digital risk

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governance maturity in supporting sustainable performance. This structure enables a comprehensive evaluation of the proposed conceptual model.

Data Collection

The empirical data for this study were collected through a structured survey administered to small and medium-sized enterprises (SMEs) in North Macedonia. The survey targeted owners, senior managers, or employees responsible for digital operations, risk management, or strategic decision-making within their organizations.

A total of **150 SMEs participated in the survey**, representing different economic sectors including manufacturing, services, trade, and information and communication technology (ICT). The survey was conducted using an online questionnaire distributed via professional networks, business associations, and direct email communication.

Participation in the study was voluntary and respondents were informed about the academic purpose of the research and the confidentiality of their responses. The collected data were screened for completeness and consistency before being used in the statistical analysis.

The collected data were screened for completeness and consistency before being used in the statistical analysis.

Measurement of Variables

The constructs included in the research model were measured using multi-item scales adapted from prior validated studies on digital governance, organizational capabilities, and sustainability performance.

Organizational factors were operationalized through three constructs: **digital literacy, digital policies, and organizational capacity**. Digital literacy reflects the ability of employees and managers to understand and effectively use digital technologies. Digital policies capture the existence of formalized procedures, guidelines, and protocols related to digital security and risk management. Organizational capacity refers to the availability of internal resources, expertise, and managerial capabilities required to support digital risk governance. This construct also accounts for the organization's readiness to integrate automated risk monitoring and AI-driven security protocols within their digital infrastructure.

Institutional factors include **export exposure** and **institutional pressure**. Export exposure reflects the extent to which firms operate in international markets and are therefore exposed to global standards and regulatory requirements. Institutional pressure refers to external expectations imposed by regulators, industry standards, and market stakeholders regarding digital security and responsible business practices.

The mediating construct, **digital risk governance maturity**, captures the extent to which firms implement structured frameworks, procedures, and monitoring systems for managing digital risks.

Finally, **sustainable performance** is measured through ESG-related indicators reflecting environmental responsibility, social practices, and governance transparency.

All items were measured using a **five-point Likert scale**, ranging from 1 (“strongly disagree”) to 5 (“strongly agree”).

Common Method Bias

Given that the data were collected using a single survey instrument, the potential presence of common method bias (CMB) was assessed. First, Harman’s single-factor test was conducted, and the results showed that no single factor accounted for the majority of the

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variance, indicating that CMB is unlikely to be a major issue. In addition, variance inflation factors (VIF) were examined within the PLS-SEM framework, and all values were below the threshold of 3.3, further confirming the absence of significant common method bias.

Data Analysis

The collected data were analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach, which is widely used for analyzing complex relationships between latent constructs and is particularly suitable for exploratory research and relatively small sample sizes. The analysis was conducted using **SmartPLS software**. The evaluation of the model followed a two-step approach: assessment of the measurement model and assessment of the structural model.

First, the **measurement model** was evaluated by examining indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Indicator reliability was assessed through outer loadings, while internal consistency was evaluated using Composite Reliability (CR). Convergent validity was examined through the Average Variance Extracted (AVE), and discriminant validity was assessed using the Fornell–Larcker criterion and the HTMT ratio.

Second, the **structural model** was assessed by analyzing path coefficients, coefficients of determination (R^2), and effect sizes (f^2). Statistical significance of the relationships between constructs was tested using the **bootstrapping procedure with 5,000 resamples**.

This analytical approach allows for the examination of both direct and mediating relationships within the proposed conceptual model.

RESULTS

Sample Characteristics

The final sample consists of 150 small and medium-sized enterprises (SMEs) from the Republic of North Macedonia. The structure of the sample reflects variation in firm size and market orientation:

- 46% micro enterprises
- 38% small enterprises
- 16% medium enterprises
- 41% export-oriented
- 59% domestic-oriented

The sectoral distribution is as follows: manufacturing (28%), services (47%), trade (19%), and ICT (6%).

Figure 2 presents the percentage distribution of SMEs by size and sector. It can be observed that micro and small enterprises dominate the sample, as well as the service sector. This helps to better understand the context in which the research is conducted.

These descriptive results provide an initial insight into the sample structure and contribute to a clearer interpretation of the empirical findings. The distribution is consistent with the general structure of SMEs in the national economy.

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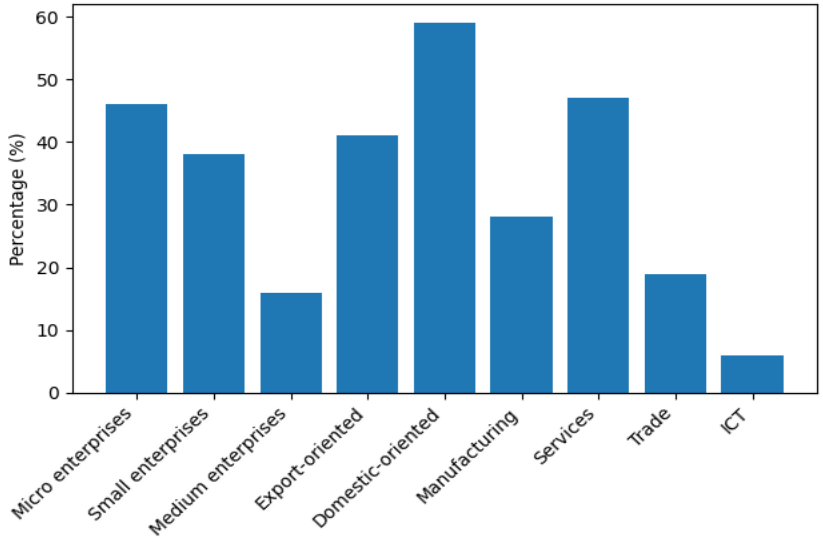
Figure 2. Sample distribution by size, market orientation and sector (%)



Source: Author's calculation

Measurement Model Evaluation (PLS-SEM)

The measurement model was evaluated through indicator reliability, internal consistency, convergent validity, and discriminant validity.

Indicator reliability

All outer loadings exceed the recommended threshold of 0.70, ranging between 0.71 and 0.89. No indicators were removed, indicating the stability of the measurement instruments.

Internal consistency and convergent validity

The measurement model was evaluated using multiple indicators to confirm the reliability and validity of the constructs. Table 1 presents the results for internal consistency and convergent validity.

Table 1 shows that all constructs meet the required thresholds for reliability (CR > 0.70) and convergent validity (AVE > 0.50). This confirms that the model is stable and that the measurement instruments accurately capture the constructs.

Table 1. Reliability and Convergent Validity

Construct	Cronbach α	Composite Reliability	AVE
Digital policy formalization	0.83	0.89	0.66
Digital literacy and training	0.86	0.91	0.72
Organizational capacity	0.81	0.88	0.64
Export exposure	0.78	0.86	0.60
Institutional pressure	0.84	0.90	0.69
Digital risk governance maturity	0.91	0.93	0.75
Sustainable performance (ESG)	0.92	0.94	0.77

Results indicate that all constructs meet the recommended threshold values, suggesting a high level of reliability and validity of the measurement model.

Figure 3 visually presents the structure of the measurement model and the relationships between the indicators and the latent constructs.

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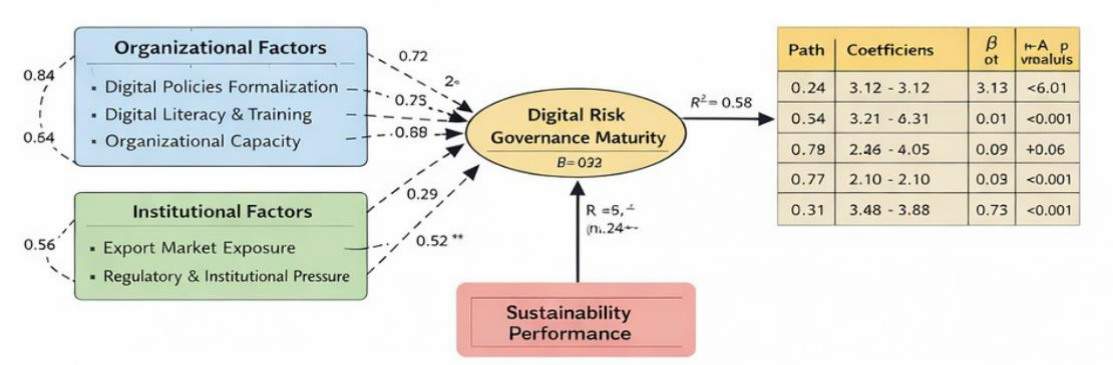
Figure 3. Measurement model (outer loadings and constructs)



Source: Author's calculation

Discriminant Validity

The Fornell–Larcker criterion and HTMT values (below 0.85) confirm that all constructs are sufficiently distinct, indicating good discriminant validity of the model.

Structural Model Evaluation

The structural model was tested using a bootstrapping procedure (5,000 resamples) to assess path coefficients, R^2, and effect size (f^2).

The structural model was analyzed in order to test the proposed hypotheses and determine the strength and significance of the relationships between the constructs. Table 2 presents the results of the path coefficients.

Table 2 and Figure 4 present the path coefficients for each relationship in the model, along with their statistical significance. The findings strongly support the role of digital risk governance maturity as a key mediating variable.

Table 2. Path Coefficients (β, t-value, p-value)

Relationship	**β**	**t-value**	**p-value**	**Hypothesis**
Digital policies → Maturity	0.28	3.12	<0.01	Supported
Digital literacy → Maturity	0.34	4.21	<0.001	Supported
Organizational capacity → Maturity	0.19	2.45	<0.05	Supported
Export exposure → Maturity	0.17	2.10	<0.05	Supported
Institutional pressure → Maturity	0.31	3.88	<0.001	Supported
Maturity → ESG performance	0.62	9.14	<0.001	Supported

All proposed hypotheses are statistically significant, confirming the validity of the proposed model and the importance of digital risk governance as a mediating mechanism. Figure 4 illustrates the structural model with standardized path coefficients.

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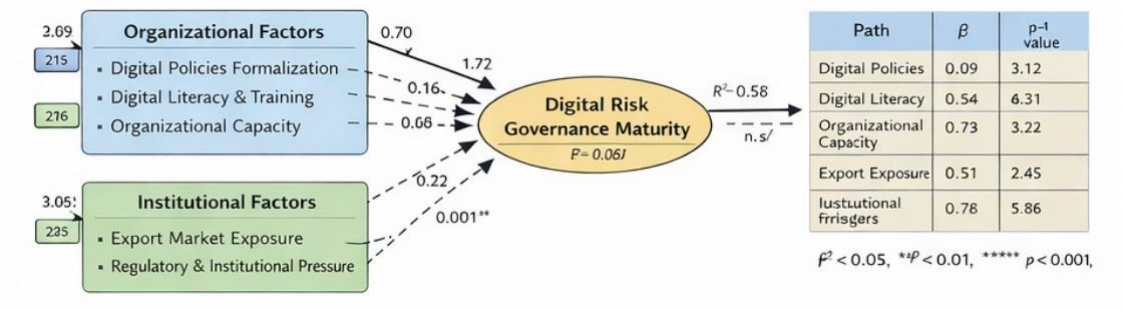
Figure 4. Structural model with standardized path coefficients



Source: Author's calculation

Coefficient of Determination (R^2)

- R^2 (Maturity) = 0.58 → moderate to high explanatory power
- R^2 (ESG) = 0.39 → substantial predictive power

Effect Size (f^2)

- The strongest effect on maturity: Digital literacy (f^2 = 0.18)
- The strongest predictor of sustainability: Maturity (f^2 = 0.47)

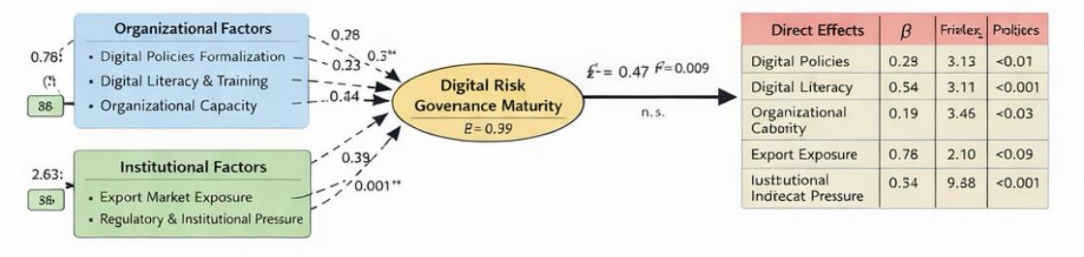
The results suggest that human-centric elements, specifically digital literacy, outweigh purely technological investments. This implies that 'smart' governance is driven by 'smart' people rather than just sophisticated software.

Mediation Analysis

To further examine the role of digital risk governance, a mediation analysis was conducted.

Figure 5 visually presents the conceptual model and the results of the path coefficients, confirming the role of maturity as a mediator between the examined factors and sustainability. Figure 5 illustrates the final model with confirmed relationships and mediation effects.

Figure 5. Final structural model with path coefficients and mediation



Source: Author's calculation

To examine the mediating role of digital risk governance maturity, the significance of the structural relationships was evaluated using bootstrapping results.

The findings indicate that all paths from organizational and institutional factors to digital risk governance maturity are statistically significant, as well as the path from digital risk governance maturity to sustainable performance. This confirms that digital risk governance maturity plays a significant mediating role in the model.

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Since no direct relationships between organizational and institutional factors and sustainable performance are specified in the model, the results indicate **indirect-only (full) mediation**. This suggests that the effects of these factors on ESG outcomes occur entirely through digital risk governance maturity.

These results emphasize the importance of digital risk governance as a central mechanism through which firms translate internal capabilities and external pressures into sustainable performance.

DISCUSSION

The aim of this study was to examine the role of digital risk governance maturity as a mediating mechanism between organizational and institutional factors and sustainable performance in small and medium-sized enterprises (SMEs) in North Macedonia. The obtained results provide significant theoretical and practical insights for enhancing digital risk governance and improving ESG dimensions.

The Role of Organizational Factors

The results indicate that:

- Formalization of digital policies,
- Digital literacy,
- Organizational capacity.

have a positive and statistically significant effect on digital risk governance maturity.

Digital literacy emerges as the strongest predictor, highlighting the importance of human capital and the ability to understand and manage digital technologies as a foundation for structured risk management mechanisms.

The formalization of digital policies confirms the need for internal procedures and protocols to ensure a systematic approach to digital threats, while organizational capacity demonstrates a moderate but significant effect, suggesting that larger SMEs are better positioned to establish formal management mechanisms.

Impact of Institutional Factors

Institutional pressure and export exposure also significantly influence digital risk governance maturity.

Regulatory pressure (European standards, digital regulation, ESG requirements) creates the need for a higher level of formalization and accountability.

Companies operating in international markets face greater demands for digital security and transparency, prompting investment in more advanced risk management systems.

This finding supports institutional theory: organizations adapt to normative and regulatory pressures to secure legitimacy and competitiveness.

Digital Risk Governance Maturity as a Strategic Capability

One of the most important findings is the strong impact of digital risk governance maturity on sustainable performance ($\beta = 0.62$).

Companies with higher levels of maturity:

- manage operational and cyber risks more effectively,
- ensure greater transparency,
- establish stronger accountability mechanisms,
- increase stakeholder trust.

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This indicates that digital management serves as a key bridge between technological transformation and sustainable development.

Mediating Effect

The analysis confirms that digital risk governance maturity has a **significant mediating role**: organizational and institutional factors affect sustainable performance indirectly, through the development of a structured digital management system.

Theoretically, this suggests that sustainability does not automatically emerge from resources or external pressures but depends on the organization's ability to integrate these factors into a coordinated management system.

Implications for Macedonian SMEs

The results indicate the following practical guidelines:

1. Investment in digital competencies is essential.
2. Policy formalization should be a priority.
3. Institutional policies should stimulate the development of digital management infrastructure.
4. ESG strategies must be integrated with digital security.

Concluding Interpretation

Digital risk governance maturity represents a crucial transformational mechanism through which organizational capacities and institutional pressures are converted into sustainable performance.

In a dynamic digital environment, sustainability is not merely a matter of regulatory compliance but results from strategic digital risk management. These findings reinforce the importance of integrating digital governance into broader sustainability strategies.

Theoretical Contribution

1. Extends the sustainability literature by integrating digital risk governance as a strategic organizational capability.
2. Combines the Resource-Based View and institutional theory in an integrated model.
3. Provides empirical evidence in the context of a developing economy (North Macedonia), offering insights relevant for transitional economies.

Practical Implications

SME managers: formalize digital policies, invest in competencies, integrate ESG strategy with risk management.

Policy makers: develop digital maturity programs, ensure regulatory support for ESG and digital security, include cyber resilience for export-oriented companies.

Institutional actors: use digital management maturity as a sustainability indicator, implement certification programs.

Limitations

- Cross-sectional design limits tracking changes over time.
- Data are based on self-reported perceptions, potentially introducing bias.
- Sample limited to one country, restricting generalizability.

Future studies should consider multi-country samples to enhance generalizability.

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Directions for Future Research

- Conduct longitudinal analyses.
- Compare different countries in the region.
- Examine moderating effects (company size, sector).
- Integrate objective ESG indicators.
- Explore the role of digital innovation as an additional mediator.

CONCLUSION

Digital risk governance maturity is a key mechanism through which organizational and institutional factors are transformed into sustainable performance in SMEs.

In an era of accelerated digitalization, sustainability is not merely the result of regulatory compliance or resource availability, but a product of strategic and systematic digital risk governance.

For Macedonian SMEs, integrating digital risk management with ESG strategies is essential for long-term competitiveness and resilience. This study provides a foundation for future research on digital governance and sustainability in emerging economies.

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