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EXPLORING THE NON-LINEAR IMPACTS OF DIGITAL MATURITY ON CORPORATE SUSTAINABILITY: NEW EVIDENCE FROM TÜRKİYE

Dijital Olgunluğun Kurumsal Sürdürülebilirlik Üzerindeki Doğrusal Olmayan Etkileri: Türkiye'den Yeni Kanıtlar

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Abstract

This study explores the impact of digital maturity on the environmental, social, and governance (ESG) performance of Turkish companies listed on Borsa Istanbul. The analysis is based on a sample of 49 non-financial firms included in the BIST 100 Index, covering the period of 2016-2022. A digital maturity index is constructed using a text mining approach to quantify the frequency of digital-related terms in the firm's annual reports. Panel data analysis is employed to investigate the relationship between digital maturity and ESG performance. The findings indicate that digital maturity has a significant inverse U-shaped effect on social performance, an insignificant inverse U-shaped effect on environmental performance, and an insignificant U-shaped effect on corporate governance performance. The results suggest that moderate levels of digitalization enhance social performance, whereas excessive digitalization may have an adverse effect.

Keywords:
Digital Maturity, Emerging Markets, ESG Performance, Sustainability, Türkiye.

JEL Codes:
G10, G30, O33, Q56.

Öz

Bu çalışma, dijital olgunluğun Borsa İstanbul'da işlem gören Türk şirketlerinin çevresel, sosyal ve yönetişim (ÇSY) performansı üzerindeki etkisini araştırmaktadır. Analiz, BIST 100 Endeksi'nde yer alan ve 2016-2022 dönemini kapsayan 49 finansal olmayan firmadan oluşan bir örneklem temel alınarak yapılmıştır. Firmaların yıllık raporlarında dijitalleşme ile ilgili terimlerin sıklığını ölçmek için metin madenciliği yaklaşımı kullanılarak bir dijital olgunluk endeksi oluşturulmuştur. Dijital olgunluk ile ÇSY performansı arasındaki ilişkiyi araştırmak için panel veri analizi kullanılmıştır. Elde edilen bulgular, dijital olgunluğun sosyal performans üzerinde anlamlı, ters U şeklinde bir etkiye, çevresel performans üzerinde anlamsız bir ters U şeklinde etkiye ve kurumsal yönetişim performansı üzerinde anlamsız bir U şeklinde etkiye sahip olduğunu göstermektedir. Sonuçlar, orta düzeyde dijitalleşmenin sosyal performansı artırdığını, aşırı dijitalleşmenin ise olumsuz etkiye sahip olabileceğini göstermektedir.

Anahtar Kelimeler:
Dijital Olgunluk, Gelişmekte Olan Pazarlar, ESG Performansı, Sürdürülebilirlik, Türkiye.

JEL Kodları:
G10, G30, O33, Q56.

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1. Introduction

The digital revolution has fundamentally transformed business practices, creating a high-quality, data-driven environment that compels firms to adopt forward-looking strategies (Van Veldhoven and Vanthienen, 2022). As digital transformation accelerates, production processes have become increasingly intelligent, services more personalized, and managerial operations highly automated (Yang et al., 2024a). In response, companies develop new business models, reallocate resources, and deliver innovative products to meet the evolving expectations of customers (Dias et al., 2021; Di Vaio et al., 2021). Digitalization also strengthens firms' value propositions, significantly reshaping how they engage with stakeholders (Wu et al., 2021; Hajishirzi et al., 2022). To maintain competitiveness in this dynamic landscape, firms are increasingly expected to enhance their performance in environmental, social, and governance (ESG) pillars.

In the realm of sustainability, ESG issues have gained growing importance at both operational and strategic levels. Institutional stakeholders increasingly expect companies to integrate digitalization and sustainability into their core operations to enhance efficiency, resilience, and long-term financial performance. In this frame, a high degree of digitalization enables firms to more effectively identify stakeholder expectations and respond to them in a timely manner, thereby improving sustainability performance (Yang et al., 2024b). Within this context, digital maturity serves as a catalyst reflecting the extent to which a firm has embedded digital capabilities into its operations, organizational culture, and strategic direction—ultimately influencing overall corporate performance. Digital maturity goes beyond the mere adoption of isolated digital technologies; it represents a comprehensive transformation that enables firms to thrive in the digital era. Firms progress through various stages of digital maturity, ranging from early adoption to full-scale integration. At advanced levels of digital maturity, firms show proactive use of technology, innovative data-driven strategies, and greater agility in responding to market dynamics. Within the scope of this study, digital maturity is expected to act as an enabler of ESG performance by fostering transparency, efficiency, and stakeholder engagement.

While digitalization and sustainability are global priorities, these concepts hold particular significance for emerging markets due to their unique characteristics—such as rapid economic growth, limited transparency, and underdeveloped regulatory frameworks, all of which can hinder ESG performance (Aksoy et al., 2020; Lozano and Martínez-Ferrero, 2022). Both shareholders and stakeholders place increasing emphasis on firms' environmental practices, social responsibility, and governance performance in these markets. Limited studies that focus on the interaction of digital transformation and ESG performance in emerging markets have shown that digital means stimulate sustainability performance through boosting transparency and accountability and magnifying environmental and social transitions across industries (Hilali and Manouar, 2020; Castro et al., 2021; Yang and Han, 2024). In this regard, digital advancements improve the flow of information, elevate the quality of corporate disclosures, and reduce informational asymmetries among stakeholders (Di Vaio et al., 2021).

However, significant differences in digitalization levels and ESG performance exist across firms, largely due to variations in industry characteristics and internal factors such as firm size, capital structure, and global orientation. Digital transformation often requires substantial investment and carries a risk of failure, which can, in turn, adversely impact ESG performance. Moreover, advanced levels of digitalization may introduce new challenges for firms, employees,

and external stakeholders—such as ambiguity around rights and responsibilities, health concerns related to technology use, and diminished social engagement (Robertsone and Lapina, 2023). These complexities highlight the importance of carefully examining the interaction between digital maturity and ESG performance. In this context, exploring the potential non-linear relationship between the two is essential for guiding a well-structured and responsible digital transformation.

This study investigates the impact of digital maturity level (DML) on ESG performance, recognizing that both digitalization and sustainability serve as key drivers of corporate success. The primary objective is to explore whether—and how—DML acts as a catalyst for enhancing ESG performance, offering new evidence from an emerging market setting. Drawing on data from non-financial firms listed on the Borsa Istanbul (BIST) 100 Index between 2016 and 2022, the study constructs a Digital Maturity Index by analyzing the frequency of digital-related terms in firms' annual reports using text mining techniques. The findings reveal a significant inverse U-shaped relationship between digital maturity and social performance, suggesting that moderate levels of digitalization yield the most benefit. However, the relationship between DML and both environmental and corporate governance performance is found to be statistically insignificant. These results underscore the nuanced and dimension-specific effects of digital transformation on sustainability outcomes.

We selected Türkiye as the empirical setting for two key reasons. First, over the past decade, Türkiye has launched numerous significant initiatives and enacted environmental regulations aimed at promoting sustainability. These efforts have encouraged publicly listed companies to increasingly disclose non-financial information related to their ESG practices (UNFCC, 2023; Borsa Istanbul, 2025; Escarus, 2025). Second, Turkish government places strong emphasis on the transformative potential of digitalization and actively pushes firms to accelerate their digital development (Eroglu et al., 2024). This attempt aims to help companies catch up with advanced economies and build core competencies through digital technologies Therefore, focusing on Türkiye not only provides context-specific insights but also offers broader implications for other emerging markets undergoing similar digital transitions.

Building on these arguments, this study makes several contributions to literature. First, it advances measurement frameworks by introducing DML as a proxy for digital maturity, providing a scalable alternative to traditional firm-level assessments. Second, it investigates the potential nonlinear relationship between DML and ESG performance, exploring whether the sustainability benefits of digital capabilities emerge incrementally or are initially hindered by transitional inefficiencies until firms fully align their digital strategies with ESG goals. This nonlinear perspective provides valuable insights into the temporal dynamics of digitalization's impact on sustainability—an area that remains underexplored in existing research. Third, the study highlights the importance of a structured approach to the adoption of digital maturity, emphasizing that strategic digital investments are crucial for achieving long-term sustainability gains. In this context, it argues that digitalization can progressively enhance ESG performance by improving transparency and stakeholder engagement, particularly in emerging markets undergoing a paradigm shift driven by digital advancements. Finally, by offering practical insights for firms, this study contributes to a deeper understanding of how firms can leverage digital capabilities to enhance sustainability outcomes while mitigating potential risks.

This research is grounded in stakeholder theory and the resource-based view, both of which emphasize that digitalization enables firms to optimize resource allocation and implement sustainable practices that align with stakeholder expectations. This study extends these theoretical frameworks by showing that DML can significantly influence sustainable performance. In doing so, this study provides new insights into how varying levels of digitalization affect ESG outcomes in an emerging market setting, while also shedding light on the potential nonlinear relationship between DML and ESG performance. The results indicate that the impact of DML differs across the ESG dimensions. From a practical standpoint, the results underscore the importance of strategically managing digital transformation efforts—firms must thoughtfully design and implement digital initiatives to maximize their positive impact on ESG performance while minimizing potential drawbacks.

The remainder of the paper is structured as follows. Section 2 gives the theoretical and conceptual framework and develops the hypotheses. Section 3 provides the data, variables, and the methodological approach. Section 4 presents empirical findings, while Section 5 and 6 concludes the paper and discusses the theoretical and practical implications.

2. Theoretical Background and Hypotheses Development

2.1. Theoretical and Conceptual Frameworks

Digitalization serves as a pathway for high-quality and sustainable development of entities. Companies increasingly leverage digital technologies to optimize resource allocation, enhance operational efficiency, and improve their information integration and processing capabilities. Digital tools also reshape interactions with stakeholders and expand the boundaries of value creation. Zhong et al. (2023) asserts that digital advancement improves ESG performance by mitigating managerial short-sightedness and fostering technological innovation. From the theoretical angle, to better understand the mechanisms through which digitalization influences ESG performance, this article is structured around two dominant theories—stakeholder theory and resource-based view (RBV)— and the literature is organized into three interrelated themes: stakeholder engagement, social and environmental performance and capability development.

From the lens of stakeholder theory, digital technologies act as tools that enhance firms' responsiveness to stakeholder expectations. By facilitating real-time communication, data analytics, and transparency, digital maturity allows firms to more effectively identify and respond to the needs of employees, customers, suppliers, and regulators (Meng et al., 2022; Piccarozzi et al., 2022). Wu et al. (2022) emphasize that digital technologies streamline the preparation of sustainability reports, improving their transparency and drawing greater stakeholder attention to ESG practices. Within this context, the integration of artificial intelligence and predictive analytics facilitate the collection, and analysis of data about customers, and suppliers, enabling firms to more effectively align their ESG initiatives with stakeholder demand (Kohtamäki et al., 2020; Cardinali and De Giovanni, 2022). However, increased digital transparency can also expose firms to greater public scrutiny, intensifying stakeholder pressure for environmental and social accountability (Orlitzky et al., 2017; Na et al., 2022). Thus, companies must strike a balance between leveraging digital tools for stakeholder engagement and managing reputational risks associated with heightened visibility.

A second theme in the literature concerns the role of digitalization in improving social and environmental outcomes. Digital transformation presents numerous opportunities to enhance the affordability and accessibility of services for broader audiences at substantially lower costs. Several studies highlight how digital tools strengthen firms' capabilities in managing social initiatives and fostering green innovation, thereby enhancing social and environmental performance (Ciarli et al., 2021; Yang et al., 2023; Xu et al., 2024). For instance, mobile technologies can enhance community engagement, while simulation models help firms reduce emissions and optimize resource use. Digitalization also facilitates value creation by reshaping organizational culture and influencing employees' mindset (Cardinali and De Giovanni, 2022). Digitally advanced workplaces often provide more favorable working conditions, support a healthy work-life balance, and increase employee resilience (Yalina and Rozas, 2020). Empirical evidence from Europe and China supports these claims: Mehedintu and Soava (2023) find that digital transformation correlates with reduced carbon emissions and improved social performance in European firms, while Wang et al. (2023) show similar effects in Chinese firms, including stronger commitments to environmental protection, green innovation and social initiatives.

The resource-based view offers a complementary theoretical lens, framing digital maturity as a set of dynamic capabilities that enhance ESG performance. Digital technologies allow firms to integrate internal and external resources more efficiently, promote cross-departmental collaboration, and foster innovation (Beier et al., 2022). These capabilities lead to improved ESG outcomes through better resource utilization, cost efficiency, and responsiveness to stakeholder demands. According to Barbosa et al. (2025), digital transformation creates synergistic value by enabling firms to simultaneously pursue economic performance and sustainability goals. The emphasis here is not only on technology adoption but also on the development of organizational competencies that translate digital investments into long-term strategic advantages.

However, while digitalization is widely seen as a catalyst for improved ESG performance, emerging evidence suggests that its impact may not be linear. Specifically, beyond a certain threshold, higher levels of digital maturity may generate diminishing returns on ESG outcomes. This non-linear relationship arises due to several factors: high financial and energy costs associated with advanced digital infrastructure, the environmental toll of electronic waste and data center emissions, and the ethical and social concerns related to algorithmic bias, data privacy, and cybersecurity risks (Scholz et al., 2018; Yalina and Rozas, 2020; Castro et al., 2021). These risks may offset the sustainability benefits that digital technologies are intended to deliver, creating a digital sustainability paradox (Esses et al., 2021). Moreover, excessive reliance on digital systems without corresponding investments in human capital, organizational change, and ethical safeguards can limit firms' ability to realize long-term economic and social value (Sraml Gonzalez et al., 2021). This indicates that the relationship between digital maturity and ESG performance may follow a non-linear pattern, where only firms that reach an optimal level of digital integration—aligned with internal capabilities—achieve sustained performance benefits. This study addresses this non-linear relationship by developing a framework that explores how digital maturity influences ESG performance in an emerging setting.

2.2. Hypotheses Development

Digital transformation enables companies to enhance business processes and achieve improved performance, aligning with stakeholders' expectations and maximizing firm value. In

this regard, the impact of digitalization is evident in both financial and non-financial performance metrics (Ahmad and Murray, 2019; Castro et al., 2021; Yang et al., 2023). Digitalization contributes to corporate sustainability performance for three main reasons. First, digital technologies support the optimization of labor productivity, and energy consumption, reduce the marginal cost of innovation and enhance product quality, thereby significantly increasing operational efficiency. Second, digital transformation promotes greater social responsibility, narrowing the distance between firms and stakeholders. Zhao et al. (2021) claim that digitalization efforts can boost social performance by enhancing innovation capacity. Firms may timely get feedback from customers and improve service quality, raising user satisfaction. Finally, digital tools enhance management and communication processes by improving information flow, and strengthening corporate governance, which in turn drives the development of new value propositions (Anastasiadou et al., 2021; Lu et al., 2023).

As the interaction of digitalization and sustainability has evolved, many scholars have moved beyond testing simple linear relationships. A prevalent approach involves examining quadratic relationships, particularly exploring whether the link between digitalization and non-financial performance follows a U-shaped or inverted U-shaped pattern (Li, 2022; Chen et al., 2024). More recently, researchers have incorporated moderating variables into these quadratic models to gain a deeper understanding of the dynamics between digitalization and ESG outcomes (Haans et al., 2016). The following part presents the hypotheses explored in this study.

2.2.1. Digitalization and Environmental Performance

Digital technologies play a vital role in transforming various aspects of environmental sustainability, including sustainable production and waste management (Ha et al., 2022). The integration of smart devices enables companies to collect real-time environmental data, such as measurements of air and water pollution. Many studies have identified a positive relationship on how digitalization influences environmental performance (Gupta et al., 2019; Lange et al., 2020; Feroz et al., 2021). Ghobakhloo and Fathi (2021) indicate that digital transformation enhances energy efficiency using intelligent systems for energy production and distribution. Bai et al. (2020) argue that digitalized production systems facilitate advanced tracking of resource usage. Other studies suggest that digital technologies offer viable solutions for reducing carbon emissions by enabling air pollution monitoring, improving waste management, and fostering eco-friendly innovation (Chen et al., 2020; Fatimah et al., 2020; Li et al., 2020). However, when a firm exhibits low digital maturity, its existing systems may lag behind technological advancements, limiting its capability to process and act on environmental data (Li, 2022).

Some scholars suggest that digitalization may also have an adverse impact on environmental sustainability. Kamble et al. (2018) report that the extensive use of smart equipment can lead to increased energy consumption. In a study held on Italian manufacturing firms, Chiarini (2021) finds that some smart technologies had a negative impact on environmental performance. Similarly, Waibel et al. (2017) highlight that digitalization can result in higher energy usage and elevated carbon emissions. Moreover, top managers often require time to understand and adapt to advanced digital technologies, restructure organizational practices, and invest in workforce development (Warner and Wäger, 2019). A high level of digital maturity may sometimes disrupt the flow of environmental information, especially when existing systems are not equipped to manage large volumes of data. This mismatch between a firm's information

processing capabilities and demands may ultimately impair its environmental performance (Chen et al., 2024). Thus, a low to moderate level of digital maturity may be positively associated with environmental performance, whereas a moderate to high level of digital maturity may have adverse effects.

These arguments suggest that the relationship between digital maturity and environmental performance is more complex than a simple linear correlation, prompting an exploration of a curvilinear relationship between these two constructs. The benefits of digitalization tend to be more pronounced at lower levels of adoption, whereas its adverse effects become increasingly evident at higher levels. These negative impacts at advanced stages of digitalization are often attributed to the rebound effect (Lange et al., 2020). For instance, firms that adopt energy-efficient servers reduce their data storage costs. Consequently, the financial savings generated by these efficiencies may enable them to acquire additional servers and expand digital operations, ultimately leading to increased energy consumption and potential environmental harm (Gossart, 2015). Therefore, higher levels of digitalization can inadvertently encourage greater resource use, offsetting the initial environmental gains achieved through digital efforts. Building on these arguments, we propose the following hypothesis:

Hypothesis 1: There is an inverse U-shaped relationship between digital maturity and environmental performance.

2.2.2. Digitalization and Social Performance

Companies should take social responsibility into account while pursuing their own interests (Yang and Han, 2024). Digital transformation plays a critical role in promoting green innovation, and fulfilling corporate social responsibility (Zheng and Zhang, 2023; Sun et al., 2024). Smart systems help reduce workplace accidents, lower employee workload, improve quality of life for workers, and support firms in meeting their social responsibility commitments. Additionally, digital tools can mitigate information asymmetry and internal communication conflicts, thereby enhancing management efficiency (Wang et al., 2023). Recent studies indicate that digital transformation significantly boosts social performance by attracting and retaining high-quality talent (He et al., 2024; He and Chen, 2024).

Despite its positive impacts, the effect of digitalization on social performance exhibit nonlinear dynamics. Blindly pursuing high level of digitalization may create new challenges if it is misaligned with organizational structure. This misalignment can lead to increased internal conflicts, higher principal-agent costs, and a decline in the quality of internal control (Mikalef et al., 2021). The non-linear effects of digitalization on social performance are not uniform, and can vary depending on factors such as technological accessibility, societal readiness, the digital divide, and cultural context. While digitalization can foster social inclusion and improve access to opportunities, it can also exacerbate inequalities, disrupt traditional structures, and generate unintended consequences (Lythreatis et al., 2022). Thus, the relationship between digital maturity and social performance is complex and multifaceted. When digital transformation surpasses organizational needs, the associated costs rise, adaptability issues emerge, and the observable benefits diminish—ultimately leading to a potential decline in social performance. Drawing from these arguments, we put forward the following hypothesis:

Hypothesis 2: There is an inverse U-shaped relationship between digital maturity and social performance.

2.2.3. Digitalization and Corporate Governance Performance

Digital transformation requires innovation not only in technology but also in management practices, and corporate culture, directly influencing key aspects of corporate governance such as shareholders' rights, board responsibilities, and executive incentives. It increases the integration and exchange of information, facilitates coordination across departments, and reduces ambiguity in decision-making—thereby strengthening governance capabilities (Zhang et al., 2022). Digitalization also reduces information asymmetry and principal-agent costs, while improving the quality of disclosures. This, in turn, lowers the cost of information acquisition and enhances stakeholder monitoring power (Fang et al., 2022). Additionally, digital tools enable board members to promptly analyze key performance indicators, leading to more informed and timely decision-making (Farrokhi et al., 2020). They also improve auditing processes and support more effective risk management practices (Teichmann et al., 2023).

In a recent study on Chinese firms, Yang et al. (2024a) highlight that a high digitalization level led to an improved corporate governance framework by boosting innovation capabilities and reducing information asymmetry. Li et al. (2024) assert that digital technologies transform governance by facilitating process-oriented behavioral monitoring and decreasing reliance on outcome-based incentive systems. Social media platforms expand the scope of information dissemination and governance capacity, while digital tools make it easier to collect customer feedback—allowing firms to develop more competitive products that meet consumers' expectations. However, when the level of digitalization diverges from a firm's strategic direction, further advancements in digitalization may fail to generate technological benefits, particularly in enhancing communication quality. In such cases, the associated costs may begin to outweigh the benefits, thereby diminishing the positive impact of digitalization on governance performance. Grounded in these insights, we propose the following hypothesis:

Hypothesis 3: There is an inverse U-shaped relationship between digital maturity and corporate governance performance.

3. Data and Methodology

3.1. Data Sample

Our data sample consists of 49 non-financial companies listed on the BIST 100 Index and having the ESG scores for the period of 2016-2022. This timeframe is deliberately chosen as the companies were required to prepare their financial statements according to the inflation accounting application that entered into force by December 31, 2023. Out of the 49 firms in the sample, 33 of them are in the manufacturing industry, while 16 of them are in the service industry. The sectoral categorization of the firms is provided in Table A1 in the Appendix. We excluded firms with less than 3 years of observation data from the sample. We conducted the panel data analysis with 246 observations. It is worth noting that this data accounts for 37.82% of the total market capitalization of the non-financial firms listed on the BIST ALL Index, providing a high

level of representation. We extracted data from multiple sources, i.e. Public Disclosure Platform, Thomson Reuters EIKON database, and corporate annual reports.

3.2. Variables Measurement

Dependent Variable

We used corporate sustainability performance (CSP) as the dependent variable and utilized ESG scores to quantify the CSP. Thomson Reuters DataStream provides the ESG scores of firms. The environmental pillar score (Escore) measures the firm's environmental performance, the social pillar score (Sscore) reflects its social performance, and the governance pillar score (Cscore) assesses its corporate governance performance.

Independent Variable

We used calculated digital maturity (DM) as the independent variable. It quantifies the extent to which firms leverage digital transformation to enhance customer interactions, streamline operational processes, and transform business models (Hess et al., 2020). Research on quantifying DM is limited, largely due to its complexity as a firm-wide strategic transformation, making it challenging to measure (Libert et al., 2016; Gurbaxani and Dunkle, 2019). Following the relevant literature (Guo and Xu, 2021; Wu et al., 2021; Zeng et al., 2022; Su et al., 2023; Fu and Li, 2023), we applied a text mining technique to the annual reports of the firms to measure the DM. We employed MAXQDA to analyze the frequencies of the digital maturity-related keywords in the annual reports (Marjaei et al., 2019).

Based on the extensive literature review and the interviews held with the nine domain experts, we first selected 223 keywords for different levels of digital orientation in firms to construct a digital scale. Then, we processed the annual reports and calculated the frequency of the keywords by using MAXQDA software. As a last step, we normalized the keyword frequencies by dividing by the total number of pages in each report, facilitating comparisons across firms regardless of document length. The selected keywords are given in Table 1.

Table 1. The Selected Keywords Used in The Calculation of The Digital Maturity Scores

Intranet, Internet, Server, Network Infrastructure
Smart TV, Smartphone, Mobility, Internet Access, Network Coverage, Network Function, Network Map
Network Security, Information Security, Digitization, Transformation, Fiber Optic, Broadband, Quick Adaptation, Decision Making, Mobile Device, Performance Management System
Agile, Network Automation, Smart Solutions, Smart Technology, Smart Manufacturing, Data Analytics, Cloud Computing, Cloud Security, Data Privacy, Data Lake, Digital Twin, Digital Business, Digital Workforce, 5G, Optimization, Automation, Robot, Cyber Security, Innovation, Edge Computing
Artificial Intelligence, Big Data, Deep Learning, Smart Factory, Smart Agriculture, Augmented Reality, Blockchain, Business Intelligence, Digital Transformation, Image Recognition, Internet of Things, Machine Learning, Metaverse, Robotic Process Automation, Virtual Factory, Virtual Reality, Sentiment Analysis

The annual report is a formal document in which listed firms publicly disclose their financial performance for the fiscal year. It provides insights into the firm's strategic decisions

and outlook. If a firm has significant strategic shifts, these changes should be clearly disclosed in the annual report. Given the public nature of this report, entities are expected to disclose relevant information about their progress in digitalization in the annual report for ensuring transparency, building trust, and providing stakeholders with a comprehensive understanding of how a firm positions itself for future growth in an increasingly digital world (Chen et al., 2024).

Control Variables

To avoid the potential impact of other factors on CSP, we used firm profitability (Fprofit), firm size (Fsize), firm risk (Frisk), firm age (Fage) and industry as control variables. We picked up the return on assets (ROA) to calculate firm profitability. It was measured by dividing net income to total assets. Firm size was calculated by taking the natural logarithm of the firm's total assets. Firm risk was measured by dividing total liabilities to total assets. Firm age shows the period since the company was founded and is included in the model by taking its natural logarithm. Industry was used as a dummy variable. It takes the value of "1" for service industry and "0" for manufacturing industry.

3.3. Methodology

To assess the effect of DM on CSP, we conducted panel regression analysis using Stata. A dummy variable is incorporated for each year to capture anything unique to the selected period. We first estimated Equation 1 as a baseline regression model. To provide evidence for a U-shaped relationship, we regress CSP on DM and its square DM^2 in Equation 2. A significant and negative coefficient for DM^2 indicates an inverted U-shaped relationship, whereas a significant and positive coefficient for DM^2 shows a U-shaped relationship (Haans et al., 2016).

$$CSP_{i,t} = \alpha + \beta_1 DM_{i,t} + \beta_2 Fprofit_{i,t} + \beta_3 Fsize_{i,t} + \beta_4 Flev_{i,t} + \beta_5 Fage_{i,t} + \beta_6 Industry_{i,t} + \sum_{k=1}^{7} \lambda_k Year + e_{i,t} \quad (1)$$

$$CSP_{i,t} = \alpha + \beta_1 DM_{i,t} + \beta_2 DM_{i,t}^2 + \beta_3 Fprofit_{i,t} + \beta_4 Fsize_{i,t} + \beta_5 Flev_{i,t} + \beta_6 Fage_{i,t} + \beta_7 Industry_{i,t} + \sum_{k=1}^{7} \lambda_k Year + e_{i,t} \quad (2)$$

4. Empirical Findings

4.1. Descriptive Statistics

Table 2 reports the summary of the descriptive statistics, while Table 3 shows the correlation matrix. The mean score of Escore is 59.452 with a standard deviation of 25.131, showing that the Escore varies among firms in the sample. This variable also exhibits a significant positive correlation of 0.371 with DM, indicating that as DM increases, the degree of digital adaptation significantly contributes to Escore. The Sscore has a mean of 67.025 and a standard deviation of 24.237. There exists a significant positive correlation of 0.422 with DM, implying that firms with higher social scores are likely to have a higher digitalization level. Concurrently, the Cscore exhibits a mean of 53.938 and a standard deviation of 21.888. It correlates positively

with DM, denoted by a coefficient of 0.215. The average DM score is only 2.406, with a maximum score of 10.905, highlighting significant variations in the level of digitalization among the Turkish firms. For firm size and firm risk, a significant positive correlation is noted with the ESG scores, whereas a significant positive correlation is observed with firm age only for Escore. The VIF values for the explanatory variables are less than 10, indicating that multicollinearity is unlikely to affect our results.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Escore	246	59.452	25.131	0	98.88
Sscore	246	67.025	24.237	.8	97.2
Cscore	246	53.938	21.888	1.81	90.8
DM	246	2.406	1.902	.083	10.905
Fprofit	246	.077	.081	-.193	.396
Fsize	246	16.443	1.194	13.899	20.176
Frisk	246	.613	.213	.063	1.019
Fage	246	3.726	.422	2.639	4.489
Industry	246	.333	.472	0	1

Table 3. Pairwise Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Escore	1.000								
(2) Sscore	0.813*	1.000							
(3) Cscore	0.492*	0.523*	1.000						
(4) DM	0.371*	0.422*	0.215*	1.000					
(5) Fprofit	-0.019	-0.032	0.000	0.108	1.000				
(6) Fsize	0.345*	0.298*	0.302*	0.090	-0.016	1.000			
(7) Frisk	0.248*	0.348*	0.235*	0.225*	-0.420*	-0.022	1.000		
(8) Fage	0.153*	0.079	-0.037	-0.015	0.052	0.182*	-0.107	1.000	
(9) Industry	-0.140*	-0.023	0.058	0.131*	-0.235*	0.136*	0.315*	-0.342*	1.000

Note: * $p<0.05$

4.2. Estimation Results

Using the ESG scores, we run an unbalanced panel data analysis. Given that all values of the dependent variable in our analysis are non-zero, we used linear regression, i.e., ordinary least squares (OLS), to model the relationship between DM and CSP. Figure 1 displays the scatter plot with fitted lines depicting the relationship between these variables. The red line represents the quadratic fit for the relationship between DM and CSP. We first estimated a fixed effects regression model and conducted an F-test to determine if any firm-specific attributes were present. The results indicated that a pooled OLS model was not appropriate. We then conducted a Hausman (1978) test to determine the most suitable model for the data. The result indicated that for all dependent variables, the random effects model is better. Table 4 reports the results. According to the baseline regression results (Model 1a, 2a, and 3a), we could not identify a linear relationship between DM and Escore, Sscore and Cscore.

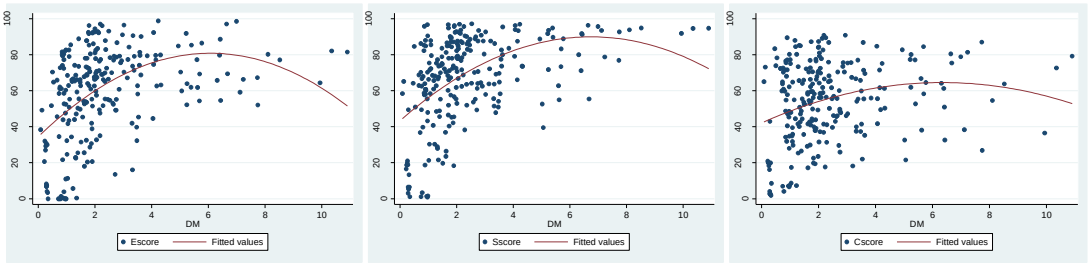

Figure 1. The Fitting Diagram of the Digital Maturity Level and ESG Scores

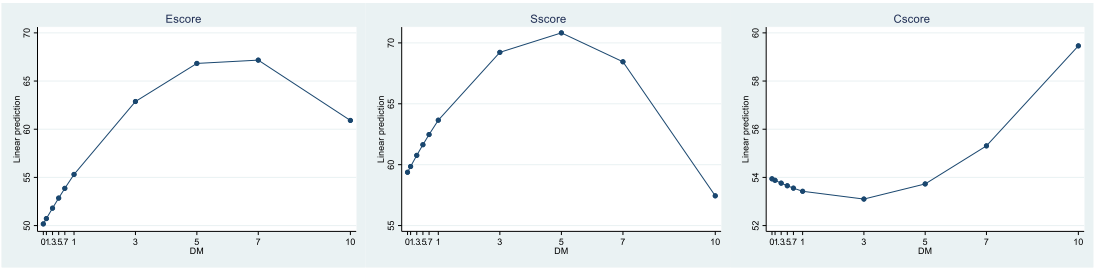

Figure 2. The Non-Linear Relationship Between Digital Maturity Level and ESG Scores

Table 4. Panel Data Analysis Results

Variables	(1a) Escore	(1b) Escore	(2a) Sscore	(2b) Sscore	(3a) Cscore	(3b) Cscore
DM	1.658	5.589*	0.477	4.772**	0.359	-0.637
	(0.948)	(2.307)	(0.704)	(1.333)	(0.980)	(3.003)
DMsq		-0.451		-0.497**		0.119
		(0.251)		(0.116)		(0.313)
Fprofit	35.833	41.935	12.292	18.849	36.724	35.436
	(24.977)	(25.103)	(20.987)	(20.643)	(25.654)	(24.671)
Fsize	6.806**	6.821**	5.358**	5.384**	4.484*	4.543*
	(1.775)	(1.717)	(1.844)	(1.781)	(1.964)	(1.971)
Frisk	25.086	22.187	29.729	25.814	22.118	23.445
	(15.443)	(14.970)	(15.948)	(15.251)	(14.957)	(14.823)
Fage	-1.434	-1.009	-6.052	-5.380	-6.584	-6.631
	(9.028)	(8.875)	(9.005)	(8.774)	(6.635)	(6.610)
Industry	-12.676	-11.106	-10.792	-8.876	-4.019	-4.517
	(7.886)	(7.626)	(8.182)	(8.123)	(5.965)	(6.114)
Constant	-70.455	-75.485	-28.338	-34.375	-12.396	-12.626
	(39.849)	(38.989)	(37.445)	(36.171)	(34.221)	(34.638)
Observations	246	246	246	246	246	246
Number of firms	49	49	49	49	49	49
Lind and Mehlum (2010) utest						
Overall utest		1.23		3.56 **		0.21
		(0.111)		(0.000)		(0.417)
Lower bound slope		2.429 **		3.561 **		-0.208
		(0.007)		(0.000)		(0.417)
Upper bound slope		-1.225		-3.831 **		0.475
		(0.110)		(0.000)		(0.317)
Extreme point		6.18		4.80		2.67

Note: Numbers in parentheses are standard errors, except for Lind and Mehlum (2010) utest, which are p-values. ** p<0.01 * p<0.05

Figure 2 shows the relationship between DM and CSP. As DM increases from 0 to 5, environmental performance improves. This suggests that firms that become more digitally mature tend to adopt practices that enhance environmental performance through more efficient resource use, better data tracking, and sustainability-focused innovations. Between DM 5 and 7, the performance gain slows down and reaches a peak (DM= 6.18), implying diminishing returns — increasing digital maturity still helps, but not as dramatically. After DM 7, environmental performance declines. Over-digitalization might introduce complexity. Although Figure 2 shows an inverted U-shaped relationship between DM and environmental performance, the regression results did not fully support this finding (Table 4, Model 1b). In Model 1b, the linear term is significant and positively ($\beta = 5.589$, $p < 0.05$) associated with Escore, but the squared term of DM is insignificant and negatively ($\beta = -0.451$, $p > 0.10$) associated with Escore. Following Haans et al. (2016) and Lind and Mehlum (2010), we applied "utest". In Model 1b, the slope for the lower bound is 2.429 ($p<0.01$), indicating that the relationship between Escore and DM is positive and significant, whereas the slope for the upper bound is -1.225 ($p>0.10$), showing that the same relationship is negative and insignificant. The overall test for the existence of a U-shaped relationship for Escore yields a t-value of 1.23 and a corresponding p-value of 0.111, suggesting that the null hypothesis is accepted, and the relationship is not inverse U-shaped. This finding partially supports Hypothesis 1. From the RBV perspective, the results show that firms improve environmental performance by implementing digital technologies. However, an intense level of digitalization in advanced stages may have its own environmental impact, i.e., high energy consumption and pollution, e-waste, which diminishes its positive effect on environmental performance. Although the result is not significant, it indicates that there is a rebound effect and corroborates the findings of prior studies (Ahmadova et al., 2022; Chen and Hao, 2022; Li, 2022).

The result for the DM in Model 2b satisfies the fundamental criteria for an inverse U-shaped relationship. The nonlinear relationship between the Sscore and DM is shown in Figure 2. The linear term is positively ($\beta =4.772$, $p < 0.01$) and the squared term of DM is negatively ($\beta = - 0.497$, $p < 0.01$) associated with the Sscore. The overall test for the existence of a U-shaped relationship for Sscore yields a t-value of 3.56 and a corresponding p-value of 0.000, suggesting that the null hypothesis is rejected, and the relationship is inverse U-shaped. In Model 2b, the slope for the lower interval is 3.561 ($p<0.01$), indicating that the relationship between Sscore and DM is positive and significant. On the other hand, the slope for the upper internal is -3.831 ($p<0.01$), implying that the same relationship becomes negative and significant. When DML is higher than the threshold of 4.80, it corresponds to a lower Sscore, whereas when it is lower than 4.80, it corresponds to a better Sscore. This finding supports Hypothesis 2. The results suggest that while early-stage digitalization enhances social performance by promoting transparency, stakeholder engagement, and workforce well-being, directly aligning with the expectations of internal and external stakeholders, a higher level of digitalization may shift the focus toward operational efficiency, potentially reducing emphasis on social considerations. This shift is further compounded by the risks associated with excessive reliance on digital technologies, which, despite boosting efficiency, can lead to job losses (Khogali and Mekid, 2023), decreased employee satisfaction (Mettler, 2024), and ethical concerns such as surveillance and biased artificial intelligence decisions (De Stefano, 2020). This transition may create tensions with stakeholder interests, erode stakeholder trust, and signal a reduced organizational responsiveness, which stakeholder theory identifies as detrimental to long-term sustainability.

In Model 3b, the linear term is negatively (β = - 0.637, p > 0.10) and the squared term of digital maturity is positively (β = 0.119, p > 0.10) associated with the Cscore, but they are all insignificant. This finding does not support Hypothesis 3. It reflects the lag in corporate governance relative to digital technological capabilities among Turkish firms and inherent implementation challenges in corporate governance structures. These challenges may include management hierarchy restructuring, workforce displacement, and process redundancies.

In Table 4, in all Models, Fsize has a positive and significant effect on sustainability pillars. Larger firms typically have more resources, enabling them to invest in ESG initiatives more effectively. This advantage allows them to implement and support comprehensive ESG strategies that align with stakeholder expectations. Moreover, they should assume more social responsibility in managing the pressures of stakeholders (Bissoondoyal-Bheenick et al., 2023).

4.3. The Robustness Tests

To mitigate the issue of reverse causality, this study incorporates lagged variables of digital maturity into the regression model, specifically lagging them by one period. As shown in Table 5, the results from the lagged model align with those of the original model, suggesting that the findings are robust and not influenced by endogeneity arising from reverse causation. Moreover, we conducted another robustness check to account for the impact of COVID-19 by including a time dummy variable (Covid19)—set to 1 for the year 2020 and 0 otherwise—in the regression, as shown in Table 6. The coefficients of the interaction terms (DMxCovid19 and DMsqxCovid19) are insignificant, indicating that the relationship between DM and CSP has not changed during the COVID-19 period.

Table 5. Panel Data Analysis Results (Lagged Variables Of DM)

Variables	(1) Escore	(2) Sscore	(3) Cscore
L_DM	5.607*	3.147*	-2.156
	(2.717)	(1.476)	(3.739)
L_DMsq	-0.465	-0.346**	0.312
	(0.320)	(0.131)	(0.412)
Fprofit	40.140	22.080	27.261
	(23.048)	(19.169)	(25.004)
Fsize	5.911**	4.939**	4.722*
	(1.677)	(1.788)	(1.909)
Frisk	18.750	31.359	22.337
	(15.837)	(16.176)	(16.362)
Fage	1.240	-2.553	-6.667
	(9.233)	(9.458)	(6.785)
Industry	-8.664	-7.892	-4.061
	(8.067)	(8.843)	(6.203)
Constant	-65.328	-36.078	-8.903
	(42.412)	(40.183)	(36.341)
Observations	196	196	196
Number of HisseID	49	49	49

Note: Numbers in parentheses are standard errors** p<0.01 * p<0.05

Table 6. Panel Data Analysis Results (Covid19)

Variables	(1) Escore	(2) Sscore	(3) Cscore
DM	5.454*	4.748**	-1.688
	(2.496)	(1.311)	(3.353)
Covid19	5.874	14.499*	-3.705
	(6.098)	(6.038)	(5.788)
DMxCovid19	0.576	-0.008	4.649
	(1.897)	(1.681)	(2.700)
DMsq	-0.430	-0.493**	0.248
	(0.272)	(0.121)	(0.364)
Covid19	-	-	-
DMsqxCovid19	-0.137	-0.041	-0.615*
	(0.178)	(0.157)	(0.273)
Fprofit	41.516	18.411	32.792
	(25.303)	(20.969)	(24.738)
Fsize	6.999**	5.547**	4.674*
	(1.761)	(1.776)	(1.976)
Frisk	21.125	24.627	23.732
	(15.262)	(15.424)	(14.960)
Fage	-1.477	-5.881	-7.038
	(8.881)	(8.713)	(6.574)
Industry	-10.985	-8.801	-4.810
	(7.624)	(8.120)	(6.129)
Constant	-74.879	-33.722	-11.641
	(39.263)	(36.364)	(34.793)
Observations	247	247	247
Number of HisseID	49	49	49

Note: Numbers in parentheses are standard error ** p<0.01 * p<0.05

5. Discussions

This study was conducted during a period when emerging market firms are experiencing intense pressure to undergo digital transformation. However, before fully embracing digitalization, companies must carefully consider its potential implications for ESG performance. Unlike many prior studies, this research brings a nonlinear relationship between digitalization and ESG performance into the discussion. Empirical findings reveal that while digitalization initially enhances social performance, its benefits diminish beyond a certain threshold—ultimately resulting in a negative impact. The identified inverted U-shaped relationship between digital maturity and social performance suggests that excessive reliance on automated systems for managing social interactions can undermine human-centered approaches essential for effective social engagement. Moreover, highly digitalized firms may face challenges in maintaining meaningful personal connections with customers, employees, and communities, potentially leading to a sense of detachment and reduced ability to meet evolving social expectations.

The results show a similar inverse U-shaped but insignificant relationship between digital maturity and environmental performance. On one side, digital transformation positively contributes to environmental performance through operational efficiency, while on the other hand, digitalization can be energy-intensive and can lead to increased emissions and energy consumption. However, it is important to note that the relationship might vary when considering different types of technologies due to their distinct environmental effects.

Although digital transformation significantly influences corporate governance and offers substantial benefits when digital technologies are integrated into governance structures, the observed insignificant relationship between digital maturity and corporate governance suggests that integrating digitalization into existing governance frameworks is not straightforward. Several factors contribute to this complexity. First, corporate governance must evolve rapidly to keep pace with technological advancements. However, this transition is demanding, as it often requires replacing or upskilling existing talent and making a significant investment (Sama et al., 2022). Second, as firms digitize their operations, they become increasingly vulnerable to cybersecurity threats—raising concerns over data breaches and the protection of sensitive information, which can seriously undermine corporate governance (Magnusson and Blume, 2022). Lastly, implementing digital governance necessitates a fundamental shift in mindset. Firms must foster a culture of continuous learning and digital literacy, which may face internal resistance and require active change management.

5.1. Theoretical and Practical Implications

5.1.1. Theoretical Implications

This study offers important theoretical implications and contributes to the growing body of literature on the relationship between digital maturity and corporate sustainability performance. It deepens the understanding of the drivers of sustainability performance by examining the impact of firm-level digital transformation through the lens of stakeholder theory and resource-based view. Our findings highlight the critical role of digitalization in influencing a firm's sustainability performance. They provide new evidence on how firms in emerging markets operating within an increasingly digital ecosystem, should align their strategies with stakeholder theory by structuring better mechanisms for transparency, stakeholder engagement, and collaboration. From a resource-based view, the results further suggest that digital maturity functions as a strategic resource, enhancing a firm's ability to reduce operational inefficiencies, promote cross-departmental collaboration, and achieve sustainable outcomes. These include improved resource optimization, lower emissions, and the development of more sustainable products.

5.1.2. Practical Implications

This study offers valuable insights for companies and policymakers, particularly in the context of emerging markets, where corporate sustainability performance holds significant importance. The results imply that while digital transformation may initially bring improvements that positively influence environmental and social performance, it is important to consider its potential negative consequences that may arise over time. This dual role of digital transformation, both enabling and disrupting, requires adaptive management strategies to maximize its benefits. Therefore, firms should adopt a long-term strategy that integrates digitalization and ESG performance, taking deliberate actions to align technological advancements with social and environmental outcomes. To support this integration, companies should invest in developing digital expertise to ensure that employees possess the necessary digital skills to drive sustainability initiatives. On the other hand, to strengthen the link between digital transformation and corporate governance, managers should leverage advanced digital tools to enhance decision-making and streamline management processes, thereby improving both operational and financial

performance. However, they must also remain aware of the potential challenges to ESG performance that can emerge at higher levels of digitalization. In this respect, our findings provide strong evidence of rebound effects —where the unintended consequences of advanced digitalization may offset earlier gains. Awareness of this risk can help managers design more effective policies and practices to mitigate negative impacts. This issue is particularly important for emerging market firms that often operate within relatively weak institutional frameworks. These firms should be conscious of their environmental footprint and implement sustainability-driven social policies to reduce the adverse impacts of digitalization.

For policymakers, the findings highlight the need to increase support for digital transformation initiatives while ensuring that ESG performance discrepancies are effectively addressed. In this respect, developing a comprehensive and strategic approach to digital transformation is essential. Policymakers should enact forward-looking policies that promote the adoption of digital technologies, support firms in implementing data-driven social and environmental strategies, and progressively integrate ESG indicators into corporate performance assessments. Each sector should have its own policy framework adjustments that can help firms to optimize their digital transition while sustaining environmental and social performance. In this frame, governments should establish a robust policy framework that aligns digital transformation with the pillars of sustainability, with a particular focus on ESG data integration and technological convergence across industries. Additionally, regulators should further encourage ESG disclosure and enhance oversight mechanisms to ensure transparency and accountability. They should motivate more companies to voluntarily report their digitalization and sustainability performance, thereby fostering a culture of responsible and transparent corporate behavior.

5.2. Limitations and Future Research

This study has several limitations that present avenues for future exploration. First, the sample is limited to listed companies, as data on digitalization and ESG pillars are more readily available for these firms. Future research could be conducted in specific industries to provide deeper insights and explore the contribution of different digital technologies to ESG performance. Second, our analysis focuses solely on Turkish companies. This geographic limitation may affect the generalizability of the findings, given the differences in institutional frameworks, culture, and digital capabilities across emerging markets. Future studies may expand the scope of analysis by conducting cross-country comparisons to validate and complement our findings. Third, this study does not include any moderating and mediating variables that could further illuminate the relationship between digital maturity and sustainability performance. Future research may benefit from incorporating such variables to obtain more nuanced and refined results. This could involve investigating contextual factors that influence the effectiveness of digital technology interventions in driving sustainability outcomes. Finally, it is important to acknowledge the limited availability of digitalization-related information in companies' annual reports, largely due to corporate confidentiality. To address this constraint, future studies could collect primary data through surveys and interviews, thereby enhancing the robustness and validity of the conclusions. Moreover, the development of sector-specific dictionaries to measure digital operations could help refine our methodology and discover the unique effects of digital transformation on ESG pillars.

6. Conclusions

Given the rapid evolution of information technologies, digitalization has become a key driver for companies aiming to improve sustainability performance across their business activities. The adoption of digital technologies offers a competitive advantage by reducing costs, increasing quality, and enabling differentiated market positioning. However, despite these benefits, a high level of digitalization may also pose challenges for ESG performance. This study explores the impact of digital maturity on corporate sustainability performance by conducting a text mining analysis of the annual reports of 49 non-financial firms listed on Borsa Istanbul, covering the period from 2016 to 2022.

The results reveal that the relationship between digital maturity and social performance follows a curvilinear pattern, characterized by an inverted U-shaped curve. While digital orientation initially enhances social performance, excessive digitalization may lead to organizational conflicts and increased costs, thereby diminishing these benefits. Regarding environmental performance, although the regression analysis identifies an inverted U-shaped relationship with digital maturity, the result is not significant. The analysis reveals different levels of significance at the lower and upper bounds of digital maturity. At lower levels, an increase in digital maturity is associated with improved environmental performance — indicating that as firms begin to digitize, they experience meaningful gains in managing environmental issues. This is reflected in a positive and statistically significant slope at the lower bound. Conversely, at higher levels of digital maturity, further increases in digitalization do not lead to additional improvements in environmental performance and may even slightly reduce it, although this negative slope is not statistically significant. This may stem from the fact that digitalization can be energy-intensive and can lead to an increase in growth-led emissions. Finally, the results did not produce evidence of a nonlinear relationship between digital maturity and corporate governance performance.

The findings contribute to a deeper understanding of sustainability performance in emerging markets, providing valuable insights for the development and execution of effective ESG strategies in the digital age. Firms should pursue balanced and well-considered digitalization policies, as excessively high levels of digitalization may negatively influence social and environmental dimensions. To leverage digital technologies for improved sustainability outcomes, firms must invest in skilled human capital, ensure adequate training, and optimize resource usage. Rather than blindly pursuing digital transformation, firms must focus on building the digital capabilities of both management and employees. Strengthening this digital capacity is essential for achieving meaningful and long-lasting improvements in sustainability performance.

Declaration of Research and Publication Ethics
This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement
The authors declare that they have contributed equally to the article.

Declaration of Researcher's Conflict of Interest
There are no potential conflicts of interest in this study.

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APPENDIX

Table A1. The Sample

Service Sector Firms (n=16)	Sub-sectors	Manufacturing Sector Firms (n=33)	Sub-sectors
AKENERJI ELEKTRIK URETIM	Electricity	AKCANSA CIMENTO SANVETC.	Others
AKSA ENERJI URETIM	Electricity	AKSA AKRILIK KIMYA SYI.	Others
BIM BIRLESIK MAGAZALAR	Food and Drug Retailers	ANADOLU EFES BIRACILIK LTD.	Beverages
BIZIM TOPTAN SATIS MAGAZA.LTD.	Food and Drug Retailers	ARCELIK	Household Goods and Home Construction
DOGUS OTO SERVIS VTC.	General Retailers	ASELSAN ELNK.SANVETC.	Aerospace and Defense
ENERJISA ENERJI	Electricity	AYGAZ	Gas, Water and Multiutilities
ENKA INSAAT VE SANAYI A	Construction and Materials	BRISA BDGSN.SLK.SANVETC.	Automobiles and Parts
MAVI GIYIM SANAYI VE TICARET	General Retailers	CIMSA CIMENTO SANVETC.	Others
MIGROS TICARET	Food and Drug Retailers	COCA COLA ICECEK	Beverages
MLP SAGLIK HIZMETLERI	Health Care Equipment and Services	EIS ECZACIBASI LLAC SINAI VE FIAL.YATIRIMLAR	Pharmaceuticals and Biotechnology
PEGASUS HAVA TASIMACILIGI A LTD.	Travel and Leisure	EREGLI DEMIR CELIK	Industrial Metals and Mining
SELCUK ECZA DEPOSU	Pharmaceuticals and Biotechnology	FORD OTOMOTIV SANAYI	Automobiles and Parts
SOK MARKETLER TICARET	Food and Drug Retailers	ISKENDERUN DEM D	Industrial Metals and Mining
TURK HAVA YOLLARI	Travel and Leisure	KARSAN OMV.SANVETC.	Automobiles and Parts
TURKCELL ILETISIM HZM.	Fixed Line Telecommunications	KEREVITAS GIDA SANVETC.	Food Producers
ZORLU ENERJI	Electricity	KORDSA TEKNIK TEKSTIL A	Others
		KOZA ALTIN ISLETMELERI	Mining
		KOZA ANADOLU MTL.MIE.	Others
		LOGO YAZLIM	Software and Computer Services
		NORTEL NETWKS.NETAS TKS.	Technology Hardware and Equipment
		OTOKAR OMV.VE SAVUNMA	Industrial Engineering
		PETKIM PETROKIMYA HLDG.	Chemicals
		PETUN ET VE UN	Food Producers
		PINAR SUT MAMULLERI SYI.	Food Producers
		SASA POLYESTER A	Others
		TAT GIDA SANAYI	Food Producers
		TAV HAVALIMANLARI	Industrial Transportation
		TOFAS TURK OTOM.FABK.	Automobiles and Parts
		TUPRAS TKI.PEL.RFNE.	Others
		TURK TKTR.VE ZIRAAT MKE.	Others
		ULKER BISKUVI SANAYI	Food Producers
		VESTEL BEYAZ ESYA SANVETC.	Leisure Goods
		VESTEL ELNK.SANVETC.	Leisure Goods