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Digital Sustainability, Sustainable Innovation Capability, Sustainable Business Model Innovation and Sustainable Organizational Performance: Unraveling the Dynamics for Manufacturing SMEs

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Abstract

This study examines the impact of sustainable digital initiatives on sustainable performance of small and medium-sized enterprises (SMEs) in the context of Moroccan manufacturing industry. It will also explore the mediation mechanism in which sustainable business model innovation (SBMI) and sustainable innovation capability (SIC) mediate the relationship between digital sustainability (DS) on sustainable organizational performance (SOP). Using data from Moroccan manufacturing SMEs across five different industry sectors, this study conducts a survey and uses partial least squares-based structural equation modelling method (PL-SEM) to validate and analyze the answers of 202 owners and managers. Data analysis has revealed that SBMI has emerged as a powerful determinant to convert sustainable digital initiatives of SMEs into sustainable performance, while SIC showed no significant impact on the relationship. The study results enhance the understanding of how Moroccan manufacturing SMEs can harness DS to sustain their performance and provide practical implications for managers to combine business models and innovation capabilities with sustainability-oriented strategies while strengthening their position in emerging markets. It also extends the knowledge concerning sustainability initiatives of Moroccan SMEs amid growing global sustainability demands.

Keywords

Digital Sustainability, Sustainable Business Model Innovation, Sustainable Innovation Capability, Sustainable Organizational Performance, Moroccan Manufacturing SMEs

1. Introduction

In the recent fast-changing digital context, small and medium-sized manufacturing enterprises (SMEs) encounter significant challenges and opportunities in leveraging their digital capabilities. The need for digital sustainability became a necessity for SMEs, especially after the huge impact of COVID-19 on market environment. Therefore, it is crucial for SMEs to understand the necessity of sustainability to effectively navigate the current digital era and secure sustainable performance and growth.

The vulnerability of SMEs to external market turbulences has been particularly evident during the COVID-19 crisis. Unlike large corporations with big resources and established digital infrastructure, SMEs faced unique challenges in implementing digital solutions while maintaining sustainability commitments. Hence, the purpose of this study is to investigate how SMEs initiate sustainable digital transformation initiatives, highlighting the need for strategic approaches that balance technological adoption with sustainability imperatives. Additionally, digital sustainability (DS) concept has emerged in recent literature as a crucial framework for SMEs to leverage responsible innovation and strategic digital capabilities while creating sustainable competitive advantages (Kotlarsky et al., 2023; Noer et al., 2025). The significance of DS for SMEs extends beyond mere survival strategies. Research indicates that SMEs that successfully integrated sustainable digital practices during the pandemic demonstrated higher resilience and achieved superior performance (Belhadi et al., 2021).

Discovering the complexities of how Moroccan SMEs interact with DS is essential for releasing their full potential and ensuring that economic development is maintained over time. For SMEs in Morocco, the stakes are particularly high. Digitalization can help overcome size-related disadvantages, integrate into supply chains, and open sustainable market niches; yet it also requires new capabilities, governance routines, and partnership models that are unevenly distributed across sectors (industry, agriculture, services) (OECD, 2020; UNCTAD, 2024).

Policymakers' efforts to build a digital ecosystem through incubators, platforms, and skills programs result in a wider transition that couples digitalization with sustainability, but firm-level pathways and performance consequences remain under-specified in SME research. This motivates a focused examination of how SMEs mobilize digital resources for sustainability and when these efforts translate into sustainable organizational performance (SOP). The narrative of DS is made more complicated by the fact that Morocco's economy is comprised of a wide variety of sectors, including industry, agriculture, and services, among others. When viewed in this light, it is absolutely necessary to investigate the implementation of digital sustainability and the influence it has on sustainable organizational performance of SMEs. A number of theoretical frameworks, including the dynamic capabilities theory (DCT), which provides insights into how DS contributes to organizational performance, since digital technologies enable organizations to identify potential opportunities, leverage market positions, and restructure resources and capabilities to address sustainability challenges (Eisenhardt & Martin, 2017; Teece, 2007). Natural resource-based view (NRBV) is also included as it provides background for this study, since companies realize NRBV advantages most when sustainability is embedded in their operational processes, not just in incremental process innovations (Hart, 1995; Hart & Dowell, 2011).

The significance of understanding SMEs' alignment with the national sustainable digital agenda is further enhanced by Morocco's commitment to developing a digital ecosystem, as demonstrated through initiatives promoting startups and innovation centers. For the purpose of informing strategic initiatives that promote sustainable economic development, policymakers, industry leaders, and researchers can all benefit from insights about the digital readiness, innovation capabilities, and transformative journeys of SMEs.

It is becoming increasingly important for SME to be digitally empowered and committed to sustainability as Morocco moves forward on the international scene and faces difficulties such as youth unemployment, economic diversification, and environmental challenges. The purpose of this study is to contribute to the literature about the DS of SMEs by offering nuanced views that are rooted in the specific context of Morocco. This study intends to provide actionable recommendations for stakeholders who are invested in the growth and resilience of Moroccan SMEs, especially in Casablanca-Settat region, in the digital era. Moreover, it examines Moroccan manufacturing SMEs to: First, explore the firm-level configuration of DS, sustainable innovation capability (SIC), and sustainable business model innovation (SBMI), second, assess their associations with SOP; and last clarify the mediating mechanisms of SIC and SBMI. By situating the analysis in an emerging-economy context such as Morocco with diverse sectoral structures and policy initiatives, the study contributes empirical evidence to the twin-transition debate and provides operational guidance for policymakers aiming to convert digital investment into durable, sustainability-aligned performance (OECD, 2020).

2. Literature Review

2.1. Digital Sustainability and Sustainable Innovation Capability

SIC is an organization's capability to build new products or frameworks that deliver environmental, economic and social benefits. DS impact SIC through enhanced knowledge sharing via digital platforms, accelerated R&D and improved stakeholder co-creation through digital channels (Borah et al., 2022; Xu et al., 2022). Research indicates that sustainable digital initiatives directly improve SIC, which in turn elevates SOP (Borah et al., 2022; Lin & Mao, 2024). Therefore, digitally enabled SMEs adapt faster, fostering sustainable innovations that confer competitive advantages.

DS pushes companies to use digital resources to advance environmental and social goals. It helps companies to create routines that companies need to sense sustainability opportunities, reconfigure processes, and scale eco-innovations, thereby strengthening sustainable innovation capability (Kotlarsky et al., 2023;

Stuermer et al., 2017). Previous studies consistently link digitalization to sustainability-oriented innovation. In manufacturing firms, in particular, digital transformation drives improvements in sustainable innovation capability (Fan et al., 2022). This means that digital capabilities are significantly raising green innovation performance, especially when paired with green supply-chain and top management's awareness of environmental issues (Cheng et al., 2024). Extending this to a strategic orientation, recent literature finds that DS initiatives positively affects green digital innovation, with capability reconfiguration acting as a driver underscoring DS as an upstream enabler of sustainability-focused innovative capacity (Xu et al., 2022).

Therefore, literature supports the hypothesis that DS is an integrative capability that systematically builds sustainable innovation capability in SMEs.

H1: Digital Sustainability positively impacts Sustainable Innovation Capability.

2.2. Digital Sustainability and Sustainable Organizational Performance

SOP balances economic, environmental, and social achievement, and is empowered by digital technologies to enable real-time monitoring, process optimization, and stakeholder transparency (Bosch et al., 2025; Nogueira et al., 2025). Chen et al., (2024) state that digital exploitation focuses on leveraging existing digital assets and exploring new digital frontiers, which in turn sustain the performance. Hence, the adoption of sustainable digitalization strategies positively affects SOP by reducing operational costs through automation, improving product quality via digital platforms, and facilitating responsiveness to market and regulatory shifts (Chen & Wang, 2024). DS has created tangible means for SMEs to facilitate SOP through higher resource efficiency, data transparency, and responsiveness towards stakeholders (Kotlarsky et al., 2023; Stuermer et al., 2017). Digital technologies at a micro level (IoT, data analytics, cloud) enable SMEs to eliminate waste, become resilient to sustainability standards, and develop resilience skills, with better operational and financial performance (OECD, 2020; UNCTAD, 2024).

In recent literature, sustainability has become a related concept to digitalization, which resulted in the emergence of the concept of DS as a crucial concept, highlighting the role of technologies adoption in achieving sustainability outcomes (Guandalini, 2022). Literature highlights the growing role of sustainable digitalization on promoting organizational performance across various dimensions, and how integrating advanced technologies enhances the efficiency of organizations within their sustainable business strategies (Sahar et al., 2025).

Existing literature highlights the growing role of sustainable digitalization in enhancing organizational performance across multiple dimensions. Organization's strategic integration of digital technologies within their sustainable business strategies enhances operational efficiency and sustainable organizational outcomes (Sahar et al., 2025).

Moreover, digitalization plays a key role in supporting sustainability goals by enhancing the organization's processes and practices, which in return supports sustainability performance, especially when digital technologies are integrated with human resource and operational strategies to improve resource optimization, and environmental performance (Setyadi et al., 2025). Therefore, DS along with digital transformation, acts as strategic drivers promoting innovation, operational efficiency and sustaining business performance when integrated within the organization's strategies. Using digital technologies strategically promotes not only productivity and value creation but also focuses and supports sustainable practices (Dahmani, 2024; Gan et al., 2023), especially in sectors going through transition towards sustainability.

To sum up, literature suggests that if companies connect digital efforts to sustainability objectives, they transform their digital capabilities into better sustainable performance at the firm level. (Kotlarsky et al., 2023; Stuermer et al., 2017; Wang & Esperança, 2023; Zhang & Huang, 2024).

H2: Digital Sustainability positively impacts Sustainable Organizational Performance.

2.3. Digital Sustainability and Sustainable Business Model Innovation

SBMI involves reconfiguring value creation logic to incorporate environmental and social values in business model configuration. DS drives SBMI by facilitating platform-based ecosystems that enable sharing and circularity, optimizing resource use through IoT and analytics, and enabling new revenue streams via data monetization (Chen et al., 2024; Wang, Yu, & Khan, 2025). Market-driven SBMI mediates the relationship between digital capabilities and SOP, since firms with strong digital strategies adopt innovative business models that enhance their sustainability outcomes (Chabowski et al., 2025; Chen & Wang, 2024). Integrating digital transformation with sustainable innovation is critical, especially with the emerging digital technologies in the market serving as strategic drivers for sustainability (Florek-Paszkowska & Ujwary-Gil, 2025). This integration promotes the development of new business models incorporating not only digital technologies but also prioritizing sustainability (Bachmann et al., 2025).

In addition, this complementary relationship is highlighted by the role of digital technologies on developing novel configurations of sustainable business model elements, such as integrative and blended value propositions, and multidimensional value capture (Gregori & Holzmann, 2020). This emphasizes the pivotal role of digital technologies in cultivating sustainable business practices and SBMI (Bachmann et al., 2025). Moreover, this integration empowers organizations to learn from dynamic environmental engagements and implement necessary innovations in their business models, particularly concerning value creation in the context of sustainability (Vaska et al., 2021). Similarly, Li et al. (2023) highlight the impact of the organization's digital platform ecosystem's characteristics on their sustainable business model factors, thereby leading innovation toward sustainability.

Overall, DS serves as key enabler for SBMI by supporting organization in achieving sustainability performance. It provides the technological foundation and strategic framework for implementing SBMI that create value for multiple stakeholders. The business model framework, enhanced with DS considerations, provides a systematic approach for SMEs to redesign business models. In addition, DS reduces coordination and transaction costs for SBMI, making circular and low-impact models viable for SMEs that otherwise lack scale (Blackburn et al., 2023; Ranta et al., 2021).

H3: The organization's digital sustainability positively influences its sustainable business model innovation.

2.4. Sustainable Innovation Capability and Sustainable Organizational Performance

SIC is refers to the firm's capability to continually create and adopt environmental and social product, process, and organizational innovations. It has been repeatedly linked to superior SOP. Literature studies in manufacturing show that firms with stronger SIC realize better environmental outcomes alongside improved corporate and financial results, because innovation cuts resource use and opens differentiation avenues (Afeltra et al., 2022; Weng et al., 2015). Recent SMEs evidence confirms that innovation capability is a significant predictor of business sustainability, even in resource-constrained contexts, highlighting its role as a dynamic capability that translates pressures and opportunities into durable triple-bottom-line gains (Olaleye et al., 2024).

Moreover, literature emphasized the positive impact of SIC on SOP by fostering sustainable competitive advantage and resilience, since firms with strong SIC are more able to integrate stakeholder demands, reduce environmental impact, and enhance overall performance outcomes (Eccles et al., 2014). Consequently, developing SIC is both a strategic and operational fundamental for organizations seeking to achieve sustainable performance outcomes. Hence, fostering SIC via knowledge integration, process redesign, and governance for eco- and social innovation is crucial to perform environmentally, socially, and economically.

H4: The Organization's sustainable innovation capabilities positively influence its sustainable performance.

2.5. Sustainable Business Model Innovation and Sustainable Organizational Performance

Innovative sustainable business models empower companies to adopt environment, social, and economic elements into their business operations. SBMI involves reconfiguring how organizations build, produce, and acquire value a way to address sustainability challenges and generate a sustainable competitive advantage. Previous research indicates that companies adopting SBMI practices see improvements in operational efficiency, stakeholder engagement, and market reputation, which together enhance their overall sustainable performance.

Moreover, the literature is increasingly focusing on SBMI that stems from its potential to provide sustainable competitive advantages within dynamic external environments (Pan et al., 2023). SBMI is highlighted as a driver for both financial and sustainability performance, and the mechanisms through which it translates into organizational performance are still not yet fully clarified (Geissdoerfer et al., 2018). Furthermore, existing literature on SBMI focuses on integrating sustainability into conventional business model elements rather than investigating it as transformative paradigm (Zhou et al., 2023). Therefore, a detailed analysis of how various dimensions of SBMI individually and collectively influence organizational outcomes is needed (Afeltra et al., 2022).

By integrating sustainability into their business models, organizations can foster innovation that supports resource efficiency, social responsibility, and environmental stewardship. (Boons & Lüdeke-Freund, 2013; Geissdoerfer et al., 2018).

H5: The organization's sustainable business model Innovation positively influence its sustainable organizational performance.

2.6. The Mediating Role of Sustainable Innovation Capability

Literature in sustainability emphasizes the mediation of sustainability-oriented innovation capabilities between the organization's sustainability practices its firm performance (Cainelli et al., 2015; Chen et al., 2006; Dangelico, 2016). Within SMEs, sustainable innovation adoption is a critical driver to performance and competitiveness under sustainability (Oduro, 2024). The impact of DS on SIC aligns with literature evidence stating that digital transformation and related sustainable capabilities define and build the company's sustainable innovation capacity by orchestrating resources and knowledge for eco-efficiency and clean technologies (Chen & Wang, 2024; Cheng et al., 2024; Fan et al., 2022). In addition, previous studies show that SIC are critical for converting digital investments into measurable performance outcomes (Chen et al., 2006; Cheng & Shiu, 2012; Dangelico, 2016).

2.7. The Mediating Role of Sustainable Business Model Innovation

SBMI is considered a primary organizational mechanism supporting the translation of DS initiatives into a sustainable performance. Literature review further argues that SBMI emerges when digital and non-digital components co-evolve, positioning it as the configurational bridge that turns DS from process-level improvements into firm-level and triple-bottom-line results affecting the performance (Bencsik et al., 2023; Palmié et al., 2025). Therefore, in the context of sustainability, companies reach performance gains when digital investments are embedded in sustainability-aligned business model designs (Chen et al., 2024). Hence the following hypotheses.

H6: The impact of digital sustainability on the organization's sustainable performance is mediated by H6a. sustainable innovation capability and H6b. sustainable business model innovation.

3. Theoretical Model

Our theoretical model illustrating the research hypotheses will be as follows:

The theoretical model of this research is shown in Figure 1, while Table 1 shows the research constructs definitions.

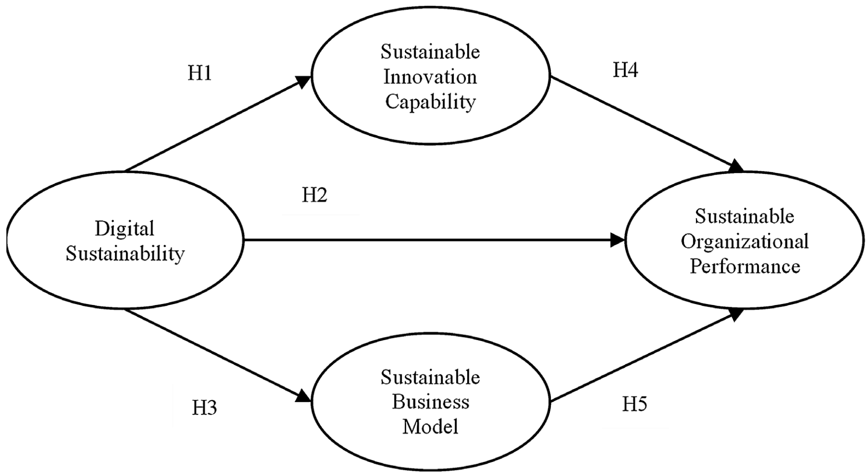

Figure 1. Research construct's model.

Table 1. Definitions of constructs.

Construct	Definition	Source
Digital sustainability	Purposeful development, governance, and lifecycle use of digital resources (e.g., data, platforms, IoT, cloud) to advance environmental, social, and economic outcomes.	Kotlarsky et al. (2023); Stuermer et al. (2017)
Sustainable Innovation Capability	A firm's ability to continually generate and implement innovations that create environmental/social value alongside economic returns (sustainability-oriented innovation capability).	Adams et al. (2016); Aas & Breunig (2017)
Sustainable Business Model Innovation	Design and implementation of business-model changes that align value creation, delivery, and capture with sustainability goals (e.g., circularity, inclusiveness).	Geissdoerfer et al. (2018)
Sustainable Organizational Performance	It is the organizational performance assessed on the triple bottom line of the three dimensions: economical, environmental, and social results.	Elkington (1997); Slaper & Hall (2011)

4. Methodology

The methodology of this study is conducted into four steps as shown in Figure 2.

4.1. Instrument Development

This study adopts a combination of well-established measurement scales developed in previous studies, which consolidates the results' validity and reliability. The measurement scale of DS has thirteen items adopted from Wang, Zhang, White and Fan (2025) and reflecting digital quality and sustainability are reinforced through the

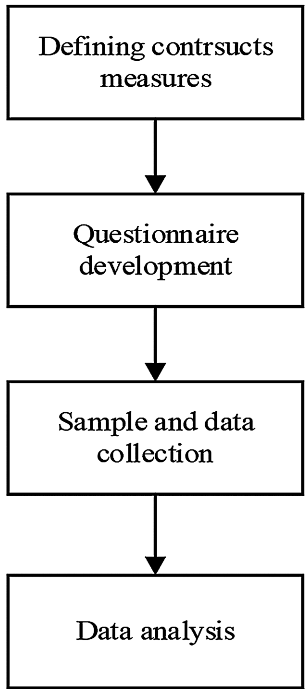

Figure 2. Methodology flowchart.

synergy of digital technology empowerment, sustainable leadership, and strategic integration. SIC is measured using five items formulated and adapted from Wang et al. (2024) and highlighting the organization's capability to encourage risk-taking in support of sustainable innovation, harness creativity to drive the development of sustainable products and services, exhibit tolerance for failure in uncertain contexts, and strategically position itself at the forefront of sustainable market innovation.

SBMI is reflected by a three-dimensional scale of ten items adapted from Bashir et al. (2022). These items are associated with sustainable value creation and proposition, in addition to advancements in value delivery and value capture innovation. The measurement scale for SOP has seven items adapted from Gadekar et al. (2022) study, assessing the company's reduction of production costs, control of waste, optimization of resource use, improvement in employee satisfaction and customer satisfaction, capability to implement environmental protection standards, and its improved e-waste management.

To ensure the robustness of our instrument, a systematic process was carried out. Key measurement items were first extracted from a thorough in-depth analysis of the literature, after which they were refined to align with the research objectives and contextual framework. For further development of the scale and to validate the constructs' structure and relevancy, we conducted a pilot panel of a team comprised of ten experienced SME managers and 4 postgraduate researchers from the relevant field of strategic management and environmental sustainability. To guarantee the constructs were appropriately structured and accurately represented the key factors, minor modifications were proposed by the experts. A pilot study was not performed, given that the items were derived from established research (Nybakk & Jenssen, 2012).

This study used the Likert scale with 7 points to operationalize the constructs, from "Strongly Disagree" to "Strongly Agree". This scale offers a structured framework for participants to express their agreement or disagreement and effectively reflect their attitudes toward each construct. The values represent the level of agreement or disagreement, where (Strongly Disagree = 1), while (Strongly Agree = 7). This systematic technique makes it possible to collect data that is both consistent and quantitative and facilitates rigorous statistical analysis and the testing of hypotheses (Dawes, 2008).

4.2. Data Analysis Approach

The survey instrument of this study was carefully crafted to capture pertinent variables pertaining to our study variables. In structural equation modeling (SEM), SmartPLS is a statistical tool often used to look at complicated relationships in a study model. This method makes it possible to look at how all the latent variables are connected and gives a strong statistical framework for checking and validating the hypotheses (Hair et al., 2017).

Using SmartPLS in the research design shows that the interplay of the main variables' DS, SIC, SBMI and SOP is being analyzed in detail. This method makes it easier to measure and quantify these relationships, which helps us get a better sense of how these factors work together in the setting of Moroccan manufacturing SMEs. This choice of quantitative method leads to results that can be applied across various contexts. This helps researchers learn more about these processes and has real-world implications for both academics and professionals in the field.

4.3. Sample and Data Collection

The study was conducted on Moroccan manufacturing SMEs. We used a database of compliant Moroccan SMEs in different manufacturing activities from Casablanca-Settat region which is the biggest region in Morocco where SMEs are highly concentrated presenting 60.5% of the total turnover of Moroccan SMEs in 2023 (OMTPME, 2024).

To be eligible, a firm had to meet four criteria. First, the SME should be qualified according to the Moroccan legal definition established by Law No. 53-00 forming the SME Charter, employing no more than 200 permanent employees and with an annual turnover not exceeding MAD 75 million (with very small enterprises with a turnover of MAD 10 million or less) (OMTPME, 2024). Second, the principal activity of the SMEs should fall within the manufacturing sector. Third, the SME should be registered and active in the Casablanca-Settat region at the time of data collection. Last, the SME should have a valid and publicly available contact information.

The sampling frame included SMEs identified via publicly available SMEs databases obtained from the Moroccan commercial register, public business directories and industry associations, which were consolidated into a single list. After removing duplicate records and entries that did not meet the eligibility criteria, the frame comprised 3150 eligible firms. Contact information was used solely for academic research purposes.

A sample of 342 SMEs was selected using systematic random sampling, and the list of these companies was screened to assess whether they were available and agreed to participate in the study. SMEs in the frame were ordered alphabetically by their names, and a random starting point was generated as a random integer between 1 and 9, and every 9th firm was selected thereafter until the target of 342 firms was reached. This study respects ethical research guidelines of protecting the respondents' confidentiality and anonymity.

The study's data were collected through the design of a structured questionnaire and the administration of a survey. To ensure cultural adaptation, questionnaires were available in both English and French, since French is the second language in Morocco. To ensure precise translation and prevent potential linguistic ambiguities for non-English speaking managers, the parallel translation method was utilized (Kalay & Lynn, 2015). The questionnaire was developed using Qualtrics and contained two sections: the First section was to gather data of the respondent's personal information (Gender, Age, Educational level, Job position, years of experience) and the respondent's company information (Industry field, company age, Company size) (**Table 2**). The second section included the four constructs from our theoretical model. 342 questionnaires were sent via email to the selected companies, with reminder emails sent in two weeks intervals. Moreover, data

Table 2. Demographic profile of research respondents.

Variable	Form	Number	Percentage
Gender	Male	138	68.3%
	Female	64	31.7%
Age	>25	32	15.8%
	26 - 45	124	61.4%
	45+	46	22.8%
Educational background	High school	3	1.5%
	Undergraduate	142	70.3%
	Graduate and above	57	28.2%
Job position	Top managers	38	18.8%
	Mid-level managers	133	65.8%
	Low-level managers	31	15.3%
Years of experience	Less than 3 years	26	12.9%
	3 to 6 years	25	12.4%
	6 to 10 years	33	16.3%
	>10 years	118	58.4%

Continued

Company age	<5 years	5	2.5%
	5 - 10 years	63	31.2%
	>10 years	134	66.3%
Company size	>10 employees (Micro)	6	3.0%
	10 - 50 employees (Small)	18	8.9%
	51 - 200 employees (Medium)	178	88.1%
Industry field	Construction materials	18	8.9%
	Chemicals, paints & detergents	19	9.4%
	Agro-food processing	23	11.4%
	Furniture, wood & joinery	17	8.4%
	Leather & footwear	20	9.9%
	Textiles & apparel	25	12.4%
	Plastics & packaging	14	6.9%
	Automotive components	50	24.8%
	Metalworking & fabricated metals	16	7.9%

were cleaned to remove irrelevant and short response time answers and verified manually to strengthen the quality of the data. We received 240 answers, 38 questionnaires with incomplete answers and 202 complete questionnaires for further analysis, yielding a response rate of 70% and a validity rate of 84%.

4.4. Common Method and Non-Response Bias

Common method and non-response bias were assessed for this study following the suggestions of Podsakoff et al. (2003). In order to control common method bias, this study used several measures during the design of the questionnaire and the process of data collection. First, clarified definitions for each variable of this study were presented to minimize the respondents' understanding bias. Second, the accuracy of the questionnaire was enhanced by adapting it to experts' feedback. In addition, common method bias was evaluated using Harman's one-factor as mentioned in previous studies (Wang & Esperança, 2023; Wang et al., 2024), and the first factor accounted for less than 50% of the total variance. This indicates that common method bias did not pose a substantial issue in this study.

5. Research Results

5.1. Research Subjects' Profiles

18.8% of the respondents were top managers, 65.8% mid-level managers and 15.3% were low-level managers working in quality, maintenance and financial departments. Most respondents are between 26 and 45 years old (61.4%), with an undergraduate educational level (70.3%), and with over 10 years of work experience (58.4%). Company profiles data show that the Moroccan manufacturing SMEs in our sample are operating in a broad range of sectors: Construction materials (8.9%), Chemicals, paints & detergents (9.4%), Agro-food processing (11.4%), Furniture, wood & joinery (8.4%), Leather & footwear (9.9%), Textiles & apparel (12.4%), Plastics & packaging (6.9%), Automotive components (24.8%), and Metalworking & fabricated metals (7.9%).

The predominant proportion of enterprises is medium-sized (51 - 200 employees) (88.1%), while small-sized enterprises with 10 - 50 employees presented 8.9% and micro-sized enterprises with less than 10 employees were 3% of the total sample. The sample of this study was drawn from multiple industries and included respondents with adequate educational and experiential backgrounds, thereby allowing respondents to answer effectively.

5.2. Study's Measurement Model

Partial least squares structural equation modelling (PLS-SEM) was selected in preference to covariance-based SEM (CB-SEM) for four reasons. First, the aim of this study is theory-development-oriented rather than purely confirmatory, a setting in which the variance-based PLS estimator is recommended. Second, the structural model is comparatively complex, incorporating two mediators (SIC and SBMI) and several simultaneous paths. Third, the analytical sample (n = 202) and the non-normal distribution of several indicators favor the distribution-free PLS algorithm, which does not require multivariate normality. Fourth, PLS-SEM performs robustly under this combination of model complexity, sample size and data characteristics (Hair et al., 2019; Sarstedt et al., 2022). All four constructs (DS, SIC, SBMI and SOP) were specified as reflective: their indicators were drawn from previously validated reflective scales, are conceptually interchangeable manifestations of a single underlying latent variable, and are expected to be highly correlated and to covary. This reflective specification is precisely why each construct is evaluated through indicator loadings, internal-consistency reliability (Cronbach's alpha, rho_A and CR), convergent validity (AVE) and the HTMT discriminant-validity criterion.

The constructs demonstrated strong internal consistency, with both CR and Cronbach's Alpha exceeding the accepted threshold of 0.70 (**Table 3**). AVE values for some construct items were below the advised threshold of 0.50, therefore, the removal of these specific items was necessary to establish a robust and valid measurement model, thereby ensuring the integrity of the subsequent structural model analysis. DS4, DS8, DS9, DS10, DS12, SIC4, SOP1 were dropped in this study. The final, refined model meets all criteria for reliability and validity, and the study's results are depicted in the following sections, thereby ensuring good convergent validity of the subsequent structural model analysis. To examine the structural validity, confirmatory factor analysis (CFA) was performed, and the results showed that the model structure is valid. Items with factor loadings greater than 0.4 were retained (**Table 4**) according to Straub et al. (2004) who emphasize that items should have a factor loading of 0.40 or more to be significant.

Table 3. Reliability and validity measures.

Variable	DS	SIC	SBMI	SOP
Digital sustainability (DS)	0.714			
Sustainable Innovation capability (SIC)	0.695	0.757		
Sustainable business model innovation (SBMI)	0.780	0.766	0.724	
Sustainable organizational performance (SOP)	0.717	0.657	0.758	0.722
Mean	5.881	5.713	5.750	5.864
SD	0.91	0.96	0.91	0.87
Cronbach's Alpha	0.862	0.750	0.899	0.817
CR	0.893	0.842	0.917	0.867
Rho_A	0.865	0.759	0.904	0.827

Table 4. Retained measurement items.

Construct items	Construct loading
Digital sustainability	
DS1	0.594
DS2	0.591
DS3	0.674
DS5	0.666
DS6	0.650
DS7	0.592
DS11	0.696
DS13	0.594
Sustainable business model innovation	
SBMI1	0.548
SBMI2	0.634
SBMI3	0.711
SBMI4	0.740
SBMI5	0.706
SBMI6	0.693
SBMI7	0.733
SBMI8	0.582
SBMI9	0.649
SBMI10	0.657
Sustainable innovation capability	
SIC1	0.550
SIC2	0.641
SIC3	0.672

Continued

SIC5	0.606
Sustainable organizational performance	
SOP2	0.450
SOP3	0.578
SOP4	0.598
SOP5	0.622
SOP6	0.701
SOP7	0.619

According to Table 5, the data display a reasonably symmetric distribution. Skewness values range from −0.730 to −0.048 and kurtosis values from −0.897 to 0.484, both of which lie within acceptable limits, supporting the assumption of normality. Furthermore, standardized outer loadings exceed 0.70 ($p < 0.001$). Furthermore, the standardized outer loadings of the retained indicators reported in Table 5 range from 0.622 to 0.814 and therefore all satisfy the 0.50 retention threshold adopted in this study (Hair et al., 2019; Hulland, 1999).

An assessment of multicollinearity using variance inflation factor (VIF) shows that all values are below the threshold of 5.0, with a maximum of 2.121, indicating that no multicollinearity concerns in the model (Hair et al., 2019).

Table 5. Cross loading, kurtosis, skewness and VIF values.

	DS	SIC	SBMI	SOP	Excess Kurtosis	Skewness	VIF
DS1	0.661				0.368	−0.312	1.52
DS2	0.684				0.013	0.171	1.58
DS3	0.786				−0.107	−0.193	1.989
DS5	0.733				2.280	−0.77	1.697
DS6	0.746				−0.092	−0.282	1.9
DS7	0.705				0.723	0.31	1.766
DS11	0.721				0.245	−0.109	1.62
DS13	0.67				1.081	−0.292	1.537
SIC1		0.686			1.350	−0.521	1.36
SIC2		0.807			0.83	0.236	1.863
SIC3		0.814			−0.07	0.082	1.859
SIC5		0.712			0.251	−0.574	1.34
SBMI1			0.622		0.024	−0.56	1.482
SBMI2			0.702		0.45	0.013	1.762
SBMI3			0.754		−0.071	−0.131	2.092

Continued

SBMI4	0.75		0.626	−0.343	1.921
SBMI5	0.768		0.364	−0.152	2.02
SBMI6	0.767		0.607	−0.255	1.988
SBMI7	0.784		0.013	0.031	2.121
SBMI8	0.668		0.03	−0.263	1.654
SBMI9	0.718		1.309	−0.459	1.815
SBMI10	0.696		0.655	−0.307	1.672
SOP2		0.632	−0.04	−0.248	1.409
SOP3		0.722	1.202	0.066	1.565
SOP4		0.731	1.637	−0.587	1.552
SOP5		0.719	0.795	−0.31	1.512
SOP6		0.782	0.953	−0.291	1.693
SOP7		0.74	0.645	−0.365	1.588

Discriminant validity was assessed using the heterotrait-monotrait ratio of correlations (HTMT), which Henseler et al. (2015) recommend as a more sensitive criterion than the Fornell-Larcker and cross-loadings approaches. Discriminant validity is established when HTMT values fall below the threshold of 0.85 for conceptually distinct constructs (Kline, 2011) or, more leniently, below 0.90 for conceptually related constructs (Gold et al., 2001; Henseler et al., 2015). The HTMT ratios were computed directly from the indicator correlations of the retained items (n = 202) and are reported in **Table 6**.

Table 6. Discriminant validity: Heterotrait-monotrait ratio (HTMT).

Construct	DS	SIC	SBMI	SOP
Digital sustainability (DS)	---			
Sustainable innovation capability (SIC)	0.863	---		
Sustainable business model innovation (SBMI)	0.875	0.883	---	
Sustainable organizational performance (SOP)	0.824	0.840	0.865	---

As shown in **Table 6**, all HTMT ratios are below the liberal 0.90 cutoff. These constructs are conceptually adjacent rather than identical, the 0.90 criterion (Gold et al., 2001; Henseler et al., 2015) is adopted as the primary benchmark; under this criterion discriminant validity is supported.

5.3. Structural Model

For inferential statistical analysis, SmartPLS was used to examine the significance of the theoretical model through bootstrapping with 5000 resamples. The model fit indices showed SRMR = 0.077 (<0.08), NFI = 0.762, dG = 0.69 (<0.95), and dULS = 0.772 (<0.95). These findings indicate that the model achieves both acceptable and significant fit (Henseler et al., 2016).

The R^2 values represent the proportion of variance in the endogenous constructs accounted for by the model. The model explains a considerable portion of variance in SIC ($R^2 = 0.484$), SBMI ($R^2 = 0.609$), and SOP ($R^2 = 0.621$). These values are considered strong, suggesting that the model has high explanatory power.

DS has strong positive effects on both mediators (SIC and SBMI). Both mediators positively and significantly predict SOP, with SBMI demonstrating the larger effect. The indirect effect of DS on SOP via SIC and SBMI is sizeable, because the direct DS → SOP path remains significant and the findings indicate partial mediation, primarily through SBMI. The results demonstrate that DS significantly and positively affects SIC ($\beta = 0.695$, $p < 0.001$), SBMI ($\beta = 0.780$, $p < 0.001$), and SOP ($\beta = 0.293$, $p < 0.001$), with the strongest effect observed on SIC and SBMI.

SBMI significantly and positively impact SOP (β=0.442, $p < 0.001$), while SIC positively, but insignificantly, affects SOP ($\beta = 0.114$, $p = 0.053$) (**Table 7**). This implies strong support for H1, H2, H3 and H5, and H4 was not supported, which is in line with existing literature (Hair Jr. et al., 2020, 2021).

Table 7. Hypothesis testing.

Hypotheses	Hypothesized Links	β	T value	*p* value	Results
H1	DS → SIC	0.695	13.66	<0.001	Supported
H2	DS → SOP	0.261	3.48	<0.001	Supported
H3	DS → SBMI	0.795	18.52	<0.001	Supported
H4	SIC → SOP	0.142	2.12	0.036	Not Supported
H5	SBMI → SOP	0.446	5.60	<0.001	Supported

5.4. Mediation Analysis

Using the PLS-SEM bootstrapping two-step approach, we tested the indirect effects DS on SOP through SIC and SBMI (Preacher & Hayes, 2008).

The indirect effects analysis reveals how the effects of DS on SOP performance are mediated through the mediation constructs SIC and SBMI. Results indicate that the mediation effect of SIC between DS and SOP is not significant ($\beta = 0.079$, $t = 2.01$, $p = 0.057$), while SBMI demonstrate a highly significant effect ($\beta = 0.355$, $t = 5.10$, $p < 0.001$). Therefore, the study supports the H6a, while H6b hypothesis is not supported (**Figure 3** and **Figure 4**).

The direct path from DS to SOP remains statistically significant ($\beta = 0.261$, $t = 3.48$, $p < 0.001$), and partial mediation of with SBMI in the DS-SOP relationship is accounting for roughly 48% of the total effect.

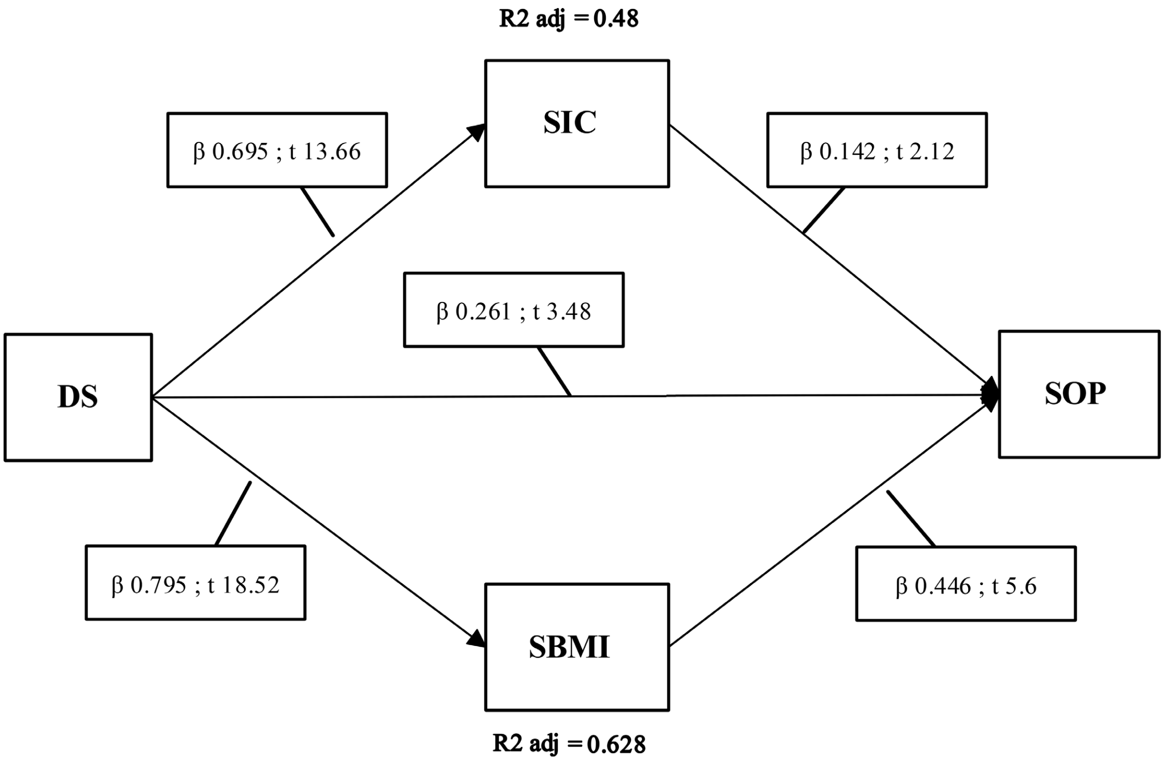

Figure 3. Structural model results.

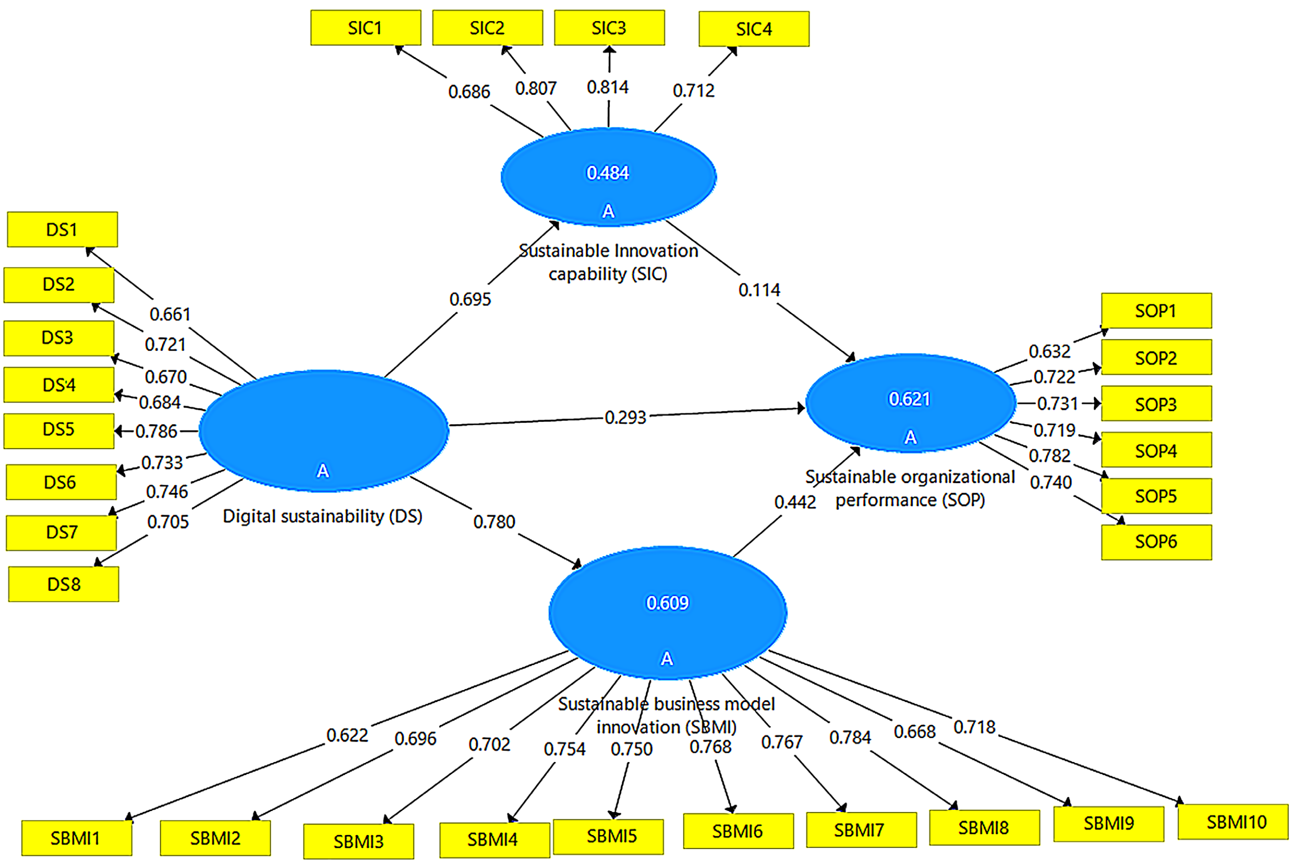

Figure 4. Relationship path.

6. Discussion

This study's results demonstrate that DS significantly and positively impact SIC, SBMI and SOP. It also indicates that DS improves SOP through SBMI, while SIC has no significant impact on that relationship. Consistent with our findings, the literature states that digital initiatives catalyze sustainability in business model innovation by supporting new value propositions, greener value creation, and sustainable value capture (Bencsik et al., 2023; Palmié et al., 2025; Ranta et al., 2021). DS shapes how SMEs capture sustainable value, especially at the business model level. These changes drive gains in market and process performance, hence the significant mediation of SBMI in in the impact of DS on SOP (Bashir et al., 2022; Foss & Saebi, 2017; Salfore et al., 2023).

SIC influence on SOP was not supported in this study. Sustainability-oriented innovation capability often results in performance gains, but these effects can be indirect or contingent on implementation factors (Afeltra et al., 2022; Weng et al., 2015). Moreover, when business model innovation is included, much of DS's impact may operate at the business model level rather than via incremental innovation capability alone. This also explains why the mediation effect of SIC is not supported. (Afeltra et al., 2022; Weng et al., 2015).

This study demonstrates that DS positively influences SIC, which is consistent with the literature that states digital technologies enable companies to seize sustainability challenges and opportunities, integrate knowledge, and reconfigure processes to deliver sustainable products and services (Ghobakhloo & Fathi, 2020; Nambisan et al., 2019; Warner & Wäger, 2019). This is consistent with dynamic capabilities theory, where digitalization enhances companies' ability to sense, seize, and transform for sustainability-oriented innovation (Teece, 2007; Teece, 2018).

DS's impact on SOP contributes to previous findings that state digitalization, when paired with sustainability objectives, yields efficiency gains and superior organizational outcomes (Cillo et al., 2019; El-Kassar & Singh, 2019). In particular, digital sustainability initiatives tend to strengthen resource optimization, which contributes to performance (Busse et al., 2016; Dubey et al., 2017; Pagell & Shevchenko, 2014).

Moreover, DS significantly drives SBMI, which consists with research on digitally enabled business model transformation, where data-driven insights and platforms facilitate new value propositions and ecosystem collaborations (Abdelkafi & Täuscher, 2016; Foss & Saebi, 2017; Geissdoerfer et al.,2018). SBMI's impact on SOP is also well supported. Innovative business models that embed sustainability create new revenue logics, optimize resource usage, and emerge into new markets, which in turn impact the company's performance (Evans et al., 2017; Ritala et al., 2018; Lüdeke-Freund et al., 2018). It is a key organizational ability to scale the benefits of sustainable digitalization practices (Boons & Lüdeke-Freund, 2013; Geissdoerfer et al., 2018).

For manufacturing SMEs, the results imply that sustainable digital initiatives are the most successful when they are explicitly directed to redesign the business model while being committed to sustainability. SMEs should pair DS initiatives with SBMI to translate technology into performance, while sustainable capabilities such as SIC remain important but may deliver value primarily when integrated in a coherent sustainable model context. (Foss & Saebi, 2017; Palmié et al., 2025; Ranta et al., 2021). Prioritizing Digital sustainability without prior investment in sustainable digital capabilities building and business model innovation may negatively affect performance benefits. Executives should redefine digital sustainability portfolios to include initiatives that build sustainable innovation capabilities and an innovative Sustainable business model. Policy-wise, incentives that push digital transparency and eco-efficiency can achieve broader outcomes if complemented with support for innovation capabilities and SBMI experimentation, especially for SMEs (Demirel & Kesidou, 2019; Ghobakhloo & Fathi, 2020).

7. Implication of This Study

The findings of this study give managers of manufacturing SMEs a clear strategic priority about digital sustainability initiatives. These initiatives generate the strongest performance returns when they are directed into redesigning the business model rather than treated as merely technology investments. Because the relationship between DS and SOP runs primarily through SBMI, managers and decisions makers should pair every digital sustainability initiative with concrete efforts to rethink value propositions, value creation, and value capture in sustainability terms. In practice, this means firms that adopt digital and sustainable technologies without reshaping how they make and deliver value risk seeing limited sustainable performance gains.

Moreover, the results reposition the role of SIC. While SIC did not show a significant direct or mediating effect on SOP, the study suggests that its value is contingent rather than absent. It is most valuable when integrated into a sustainability-focused business model rather than developed as an isolated capability. Therefore, managers are advised to build SIC and SBMI in parallel, and to sequence investments so that capability-building and model redesign reinforce one another. For decision-makers, it emphasizes the need for redefining their “digital sustainability portfolios” so that they explicitly fund initiatives that strengthen innovation capabilities and enable business model experimentation, rather than concentrating resources on digital adoption alone.

At the policy level, this study implies that incentives encouraging the adoption of DS would deliver durable results only if they support SBMI, since this was the channel through which DS actually translated into SOP. Therefore, public programs that fund digital technology adoption alone are likely to fall short of those that also help firms redesign how they create and capture sustainable value. This is especially relevant in emerging-economy manufacturing Moroccan SMEs in Casablanca-Settat region, where they lack the resources to absorb digital investments and need structured guidance to convert them into sustainability-oriented business models rather than isolated digital upgrades.

8. Limitation and Future Prospects

This study makes an important contribution by explaining the relationship between DS and SOP through SIC and SBMI. Nevertheless, several methodological and contextual constraints, each of which opens a clear avenue for future research. First, the research relies on a cross-sectional survey design, which captures relationships at a single point in time and therefore cannot establish causal direction or track how the effects of DS unfold over time. Future studies could adopt longitudinal or panel designs to confirm causal ordering and observe how DS initiatives translate into SOP gains across different stages of firm development. Second, the data are self-reported by managers, which introduces the possibility of perceptual bias; although the authors took procedural precautions and Harman's single-factor test indicated bias was not a substantial concern, self-reported measures still constrain objectivity. Therefore, future work could strengthen validity by combining survey responses with objective performance indicators, archival financial data, or multiple respondents per firm.

A further limitation concerns the sample's scope and composition. The data were drawn exclusively from manufacturing SMEs in Morocco. Future research could test the model across multiple emerging or developed economies to assess its generalizability and to identify context-specific contingencies. Finally, this study's model focuses on a specific set of variables (DS, SIC, SBMI, and SOP). Future research could incorporate more influential factors such as organizational culture, leadership, market dynamics, or external regulatory pressures as moderators or mediators to build a more comprehensive explanatory framework.

9. Conclusion

This study builds on the theories of dynamic capabilities and NRBV to investigate the impact of digital sustainability on sustainable organizational performance. It also empirically examined the mediating role of sustainable business model innovation and sustainable innovation capability. In addition, this research extends the literature of empirical research on digital sustainability in developing countries and offers key suggestions to SMEs in the manufacturing field.

Data analysis has revealed that digital sustainability shapes sustainable organizational performance in manufacturing SMEs by mobilizing two factors: sustainable innovation capability and sustainable business model innovation. Thus, digital sustainability is an upper-level strategic ability whose key performance advantages are realized when it's reconfigured as a sustainability-driven business model transformation. Instead of making an impact with marginal process optimization, digitally driven programs for sustainability perform best when they transform how companies make, offer, and earn sustainable value. In this setup, the sustainable innovation capabilities are still critical as enabling routines, but will fall short unless framed within an overt business model justification based on environmental and social goals. Theoretically, the results enrich capability-based sustainability theories by depicting the channel through which digital assets are translated into organizational performance: business model innovation is the primary channel between the company's digital sustainability initiatives and sustaining its performance. This builds upon prior work in positioning digital sustainability not as a standalone toolkit but as an integrative, reconfiguration capability to coordinate technology, governance, and stakeholder value. The findings support that digital sustainability is not only initiatives and practices, but a significant capability that redefines how companies capture the benefits of sustainable values. Sustainable business model innovation emerges as the dominant driver that translates the Digital Sustainability initiatives into performance, while sustainable innovation capability's contribution is a non-significant mediation. This emphasizes that innovation capability alone is insufficient unless paired with business model innovation in the sustainability context. This result helps clear the mixed results in prior work that treated "innovation capability" as the sole engine of sustainability performance (Tseng et al., 2019; Zhang et al., 2022).

This study is contributing to the literature on dynamic capabilities, greener innovation, and sustainable business models. For practitioners, the message is clear: To be sustainably performant, companies should instill digital sustainability initiatives while cultivating innovation capabilities and scaling innovative business models toward sustainability.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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