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Digital Intelligence and Sustainable SME Performance: The Mediating Role of Green Innovation in Indonesia

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Abstract

This study examines how digital intelligence contributes to sustainable performance among small and medium enterprises (SMEs) and whether green innovation translates digital capability into sustainability outcomes. The topic is important because SMEs increasingly adopt digital technologies while facing pressure to improve resource efficiency, environmental responsibility, and long-term competitiveness. Despite increasing digitalization, it remains unclear how digital intelligence improves sustainable SME performance and whether green innovation mediates this relationship, particularly in emerging economies. This study integrates dynamic capability theory and the natural resource-based view to explain the digital intelligence–green innovation–sustainable performance mechanism in West Java SMEs, which remains insufficiently examined. A quantitative cross-sectional survey was conducted using data from 200 SMEs in West Java, Indonesia, and the proposed relationships were tested using Partial Least Squares Structural Equation Modelling (PLS-SEM). Digital intelligence positively influences green innovation and sustainable SME performance, while green innovation improves sustainable performance and partially mediates the relationship. Digital capability generates stronger sustainability outcomes when SMEs convert digital knowledge into environmentally oriented innovation. Managers should therefore align digital investment with green product, process, and managerial improvements.

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1. INTRODUCTION

Digital technologies have changed how firms gather information, coordinate work, communicate with customers, and create value. The change is especially consequential for small and medium enterprises (SMEs), because digital platforms and data-based tools can reduce some of the scale disadvantages that traditionally limit smaller firms. Cloud applications, e-commerce platforms, digital payment systems, analytics dashboards, and integrated communication tools allow SMEs to reach markets, monitor operations, and make decisions with greater speed. Digital transformation research therefore treats technology not simply as an operational support function but as a strategic element that reshapes business processes, offerings, and organizational relationships (Bharadwaj et al., 2013; Verhoef et al., 2021; Vial, 2019). For entrepreneurial firms, digital technologies can also lower experimentation costs and support opportunity recognition, rapid learning, and flexible market entry (Nambisan, 2017). However, access to technology alone does not guarantee better performance. The organizational value of digitalization depends on whether firms can interpret digital information, combine it with managerial judgment, and use it to redesign decisions and routines.

This study uses the term digital intelligence to describe an SME's organizational capability to sense relevant digital information, interpret data and technological possibilities, integrate digital tools into work processes, and apply the resulting knowledge to strategic and operational decisions. The concept is broader than the possession of hardware, software, or social-media accounts. It emphasizes the ability to transform dispersed digital resources into coordinated action. In capability terms, digital intelligence combines technological infrastructure with managerial skills, data use, cross-functional integration, and responsiveness. This interpretation is consistent with studies showing that analytics and digital resources improve performance when they are assembled into an integrated capability rather than treated as isolated information-technology investments (Gupta & George, 2016; Wamba et al., 2017). It also reflects evidence that entrepreneurial SMEs can compete through digital platform capability when technological resources are complemented by organizational and network capabilities (Cenamor et al., 2019).

At the same time, SMEs face stronger expectations to improve environmental responsibility and long-term resilience. Rising material and energy costs, stakeholder scrutiny, waste-management concerns, and increasingly sustainability-conscious customers make environmental performance a strategic issue rather than a peripheral corporate activity. For SMEs, sustainability is particularly challenging because resource constraints can delay investment in cleaner technologies and formal environmental systems. Yet smaller firms also possess advantages: shorter decision chains, close owner involvement, and flexible routines can permit rapid operational experimentation. Sustainable SME performance therefore concerns the firm's capacity to maintain durable economic and competitive outcomes while improving resource efficiency, reducing waste and environmental harm, and strengthening operational continuity. This multidimensional view is consistent with sustainability measurement research that combines environmental, operational, and economic indicators rather than relying on a single financial measure (Ahi & Searcy, 2015).

Green innovation is a central mechanism through which firms can convert environmental pressures into practical improvement. It includes new or substantially improved products, processes, and managerial practices that reduce environmental impact, prevent pollution, save energy, minimize material use, or support cleaner production. The concept overlaps with eco-innovation, which frames innovation as a route to both environmental progress and competitiveness (Rennings, 2000). Green product innovation may involve redesigning materials, packaging, or product features, whereas green process innovation may involve energy-efficient equipment, waste reuse, improved production control, or reductions in defects and rework. Green managerial innovation may include environmental targets, supplier standards, and monitoring routines. Previous research indicates that these forms of innovation can strengthen environmental performance, efficiency, reputation, and competitive advantage (Chen, 2008; Chen et al., 2006; Dangelico & Pujari, 2010; Xie et al., 2019). Meta-analytic evidence also supports a positive overall association between environmental innovation and firm performance (Hizarci-Payne et al., 2021).

The natural resource-based view provides one theoretical foundation for this relationship. It extends the resource-based view by arguing that capabilities related to pollution prevention, product stewardship, and sustainable development can become sources of competitive advantage (Hart, 1995; Hart & Dowell, 2011). Under this logic, environmental constraints are not merely compliance costs. They can stimulate firms to improve resource productivity, redesign processes, reduce exposure to environmental risk, and differentiate offerings. This reasoning is compatible with the environment-competitiveness proposition that well-directed environmental improvement can encourage innovation and offset some of the costs of compliance through productivity gains (Porter & Linde, 1995). Green innovation is therefore expected to improve sustainable SME performance because it embeds environmental objectives in the firm's value-creation activities rather than treating them as separate philanthropic actions.

Dynamic capability theory provides a complementary explanation for the role of digital intelligence. Dynamic capabilities allow organizations to sense changes, seize opportunities, and transform their resource base in response to environmental shifts (Teece, 2018; Teece et al., 1997). Digital intelligence can strengthen sensing by improving access to customer, market, supplier, and operational information. It can strengthen seizing by supporting forecasting, scenario comparison, and faster allocation of resources. It can strengthen transformation by enabling process integration, digital coordination, and continuous adjustment. Research on digital transformation similarly emphasizes strategic renewal rather than one-time technology adoption (Warner & Wäger, 2019). From this perspective, digital intelligence should support green innovation because data and digital tools can reveal inefficient resource use, identify waste hotspots, coordinate environmental initiatives, and shorten the feedback cycle between a sustainability problem and an operational response.

The relationship is visible in practical SME activities. A food-processing SME may use demand forecasting to reduce overproduction and expired inventory. A fashion producer may use digital pattern planning and production monitoring to reduce fabric waste. A craft enterprise may use e-commerce data to test lower-impact packaging before expanding it across product lines. A small manufacturer may use energy-monitoring dashboards to identify abnormal electricity use or schedule equipment more efficiently. These practices become green innovations when digital insight is converted into a meaningful change in products, production, logistics, or managerial routines. Digital intelligence is thus not assumed to produce sustainability automatically. Its contribution depends partly on the firm's ability to direct digital knowledge toward environmental and operational innovation.

Although prior studies have examined digital capability, innovation, and performance, several gaps remain. First, much digital transformation research explains general firm performance but pays less attention to sustainability-specific outcomes. Second, green innovation research often emphasizes environmental regulation, market pressure, or green capabilities without explicitly examining the digital intelligence that can improve information processing and experimentation. Third, studies frequently test direct effects while leaving the internal mechanism between digital capability and sustainable performance insufficiently specified. A direct relationship is plausible because digital tools can immediately improve coordination and efficiency, but capability theory suggests that more durable performance gains emerge when digital resources are converted into value-creating routines and innovations. Green innovation is therefore a theoretically meaningful mediator rather than merely an additional predictor.

The novelty of this study lies in explaining this capability-conversion mechanism by integrating dynamic capability theory and the natural resource-based view in a single mediation model. Rather than examining digital capability and green innovation only as separate or direct predictors of firm performance, this study proposes that digital intelligence enables SMEs to develop environmentally oriented innovation, which subsequently contributes to sustainable performance. This perspective provides a more specific explanation of how digital capability can be translated into environmental, operational, and competitive outcomes in SMEs.

The gap is particularly relevant in emerging-economy SME contexts. Indonesian SMEs contribute extensively to employment, local production, and entrepreneurial activity, while many are still developing their digital maturity. West Java provides a relevant empirical setting because it contains a diverse concentration of food and beverage, fashion and textile, craft and creative, service, and light-manufacturing SMEs, sectors in which digital transformation and resource-efficiency challenges increasingly occur simultaneously. SMEs in these sectors must respond not only to changing digital markets but also to pressures related to material efficiency, energy use, waste reduction, and sustainable production. Their resource constraints make it important to understand whether digital capability can support sustainability without requiring the scale and formal systems of large corporations. Thus, West Java is not merely a geographical research boundary but represents an appropriate context for examining how SMEs with relatively constrained resources can convert digital capabilities into environmentally oriented innovation and sustainable performance. Evidence from this context can extend theories developed largely around larger firms and advanced economies by showing how capability conversion operates under more constrained organizational conditions.

Based on dynamic capability theory, digital intelligence enhances a firm's ability to sense relevant information, seize emerging opportunities, and transform organizational routines (Teece, 2018; Teece et al., 1997). In the environmental context, these capabilities allow SMEs to identify inefficient resource use, recognize opportunities for cleaner practices, and respond more rapidly through environmentally oriented product, process, and managerial changes. Digital intelligence is therefore expected to facilitate green innovation.

H1: Digital intelligence positively influences green innovation.

From the natural resource-based view, environmentally oriented capabilities can create competitive value by improving resource productivity, reducing environmental risks, and supporting sustainable development (Hart, 1995; Hart & Dowell, 2011). Previous studies also indicate that green innovation can improve environmental and firm performance through cleaner products and processes, resource efficiency, and competitive differentiation (Chen et al., 2006; Xie et al., 2019). Accordingly, SMEs that implement stronger green innovation are expected to achieve better sustainable performance.

H2: Green innovation positively influences sustainable SME performance.

Digital intelligence may also contribute directly to sustainable SME performance because integrated digital information and technologies can improve coordination, decision making, operational efficiency, and organizational responsiveness. Digital transformation research suggests that these benefits emerge when digital technologies are incorporated into business processes and strategic renewal rather than treated merely as technological investments (Bharadwaj et al., 2013; Verhoef et al., 2021; Vial, 2019).

H3: Digital intelligence positively influences sustainable SME performance.

However, the influence of digital intelligence on sustainable performance is unlikely to occur only through a direct route. Dynamic capability theory explains how firms mobilize and transform digital resources, while the natural resource-based view explains how environmentally oriented capabilities and innovations generate sustainable value. Combining these perspectives suggests that digital intelligence can first strengthen green innovation, which subsequently improves sustainable SME performance. Green innovation therefore represents a mechanism through which part of the value created by digital intelligence is converted into sustainability outcomes.

H4: Green innovation mediates the relationship between digital intelligence and sustainable SME performance.

Accordingly, this study examines the relationships among digital intelligence, green innovation, and sustainable SME performance and specifically tests the mediating role of green innovation. The study contributes by explaining how digital capability is converted into sustainability outcomes through environmentally oriented innovation and by examining this mechanism in the context of SMEs in West Java, Indonesia. The proposed model is summarized in Figure 1.

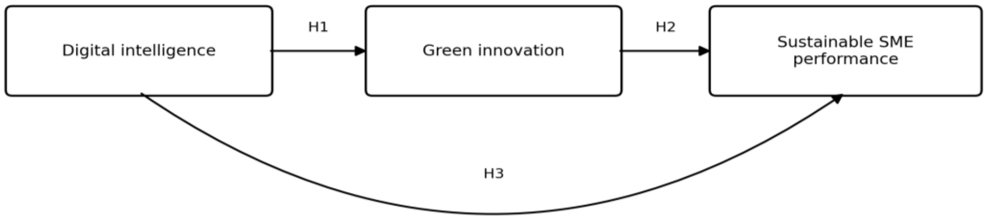

Figure 1. Conceptual model
Source: Authors' Conceptualization (2026)

2. METHODS

The study adopted a quantitative, cross-sectional research design to evaluate the proposed relationships at the organizational level. The target population consisted of SMEs operating in West Java, Indonesia. This setting was selected because the region contains a broad range of food and beverage, fashion and textile, craft and creative, service, and light-manufacturing businesses that are simultaneously exposed to digital transformation and sustainability pressures. The unit of analysis was the SME. Data were provided by owners or managers because these respondents are positioned to evaluate the firm's digital capability, innovation activities, and performance. Selecting respondents on the basis of their decision-making role functions as a key-informant criterion and reduces the likelihood that answers are supplied by individuals with limited knowledge of organizational practices.

Data were collected through a structured questionnaire containing multi-item measures for digital intelligence, green innovation, and sustainable SME performance. The instrument was organized to maintain a clear separation among the three constructs while using language that could be understood by SME decision makers. Digital intelligence was measured with five indicators covering digital capability, use of data, integration of technology into business processes, digitally supported decision making, and responsiveness to digital information. Green innovation was measured with five indicators covering environmentally oriented process improvement, waste reduction, energy efficiency, cleaner production, and environmentally oriented product or process change. Sustainable SME performance was measured with five indicators covering resource efficiency, environmental performance, operational sustainability, long-term competitiveness, and sustainable production practices. The measures were adapted from established streams of research on digital and analytics capability, green innovation, and sustainability performance (Ahi & Searcy, 2015; Chen et al., 2006; Gupta & George, 2016). Table 1 summarizes the operational focus of each construct.

Table 1. Construct operationalization

Construct	Operational focus	Indicators
Digital intelligence	Organizational ability to use and integrate digital technologies and information	Digital capability; data utilization; technology integration; digital decision support; responsiveness to digital information
Green innovation	Environmentally oriented product, process, and managerial improvement	Eco-process innovation; waste reduction; energy efficiency; cleaner production; environmental product/process improvement
Sustainable SME performance	Durable economic, operational, and environmental outcomes	Resource efficiency; environmental performance; operational sustainability; long-term competitiveness; sustainable production practices

Source: Measurement domains adapted from (Ahi & Searcy, 2015; Chen et al., 2006; Gupta & George, 2016).

A total of 200 usable SME responses were included in the analysis. The original research design referenced the ten-times heuristic commonly associated with partial least squares structural equation modeling (PLS-SEM). Applied to this model, the largest measurement block contains five indicators and the largest number of structural paths directed at an endogenous construct is two, so the achieved sample substantially exceeds the basic heuristic requirement. More importantly, the sample is appropriate for a parsimonious three-construct prediction model and permits resampling-based estimation. Contemporary PLS-SEM guidance recommends evaluating sample adequacy in relation to model complexity, statistical power, and the stability of estimates rather than relying only on a mechanical rule (Hair et al., 2019; Sarstedt et al., 2021). The achieved sample was therefore considered adequate for the intended measurement and structural assessments.

Data analysis was conducted using partial least squares structural equation modeling (PLS-SEM) through a two-stage procedure consisting of measurement model assessment followed by structural model assessment. This approach was used to first establish the reliability and validity of the constructs before evaluating the hypothesized relationships among digital intelligence, green innovation, and sustainable SME performance.

The study specified a reflective measurement model. Under reflective specification, the observed indicators represent manifestations of the underlying construct and are expected to share common variance. Measurement quality was evaluated before interpretation of the structural paths. Internal consistency reliability was assessed using Cronbach's alpha and composite reliability, with values of 0.70 or higher treated as acceptable. Convergent validity was evaluated using average variance extracted (AVE), with values above 0.50 indicating that a construct explains more than half of the variance in its indicators. Indicator loadings were also examined as part of the measurement assessment to evaluate the contribution of individual indicators to their respective constructs. Construct distinctiveness was assessed using the heterotrait-monotrait (HTMT) approach in accordance with recommended PLS-SEM practice (Hair et al., 2019; Henseler et al., 2015). These assessments were conducted to establish adequate reliability, convergent validity, and discriminant validity before proceeding to structural model evaluation.

After the measurement model was established, the structural model was assessed using PLS-SEM. This variance-based approach is suitable for prediction-oriented research involving latent-variable models with multiple indicators and for explaining variance in key endogenous constructs (Hair et al., 2019). The structural model assessment examined path coefficients, bootstrapping results, indirect effects, and the coefficient of determination (R-squared). Path coefficients were used to determine the direction and magnitude of the relationships among constructs, while bootstrapping was used to assess statistical support for the proposed hypotheses. R-squared values were examined to determine the proportion of variance explained in the endogenous constructs, namely green innovation and sustainable SME performance.

Green innovation was treated as a mediator between digital intelligence and sustainable SME performance. Mediation was assessed through the indirect effect of digital intelligence on sustainable SME performance through green innovation. Partial mediation was identified when the indirect effect was supported while the direct relationship between digital intelligence and sustainable SME performance remained positive and supported. This procedure allows the study to distinguish between sustainability gains that arise directly from digital intelligence and those that occur because digital intelligence enables environmentally oriented innovation.

Several procedural decisions were used to support the interpretation of the model. The theoretical definitions were established before hypothesis testing, and each construct was represented by the same number of indicators, reducing imbalance across measurement blocks. Respondents were asked to evaluate firm-level practices rather than personal attitudes, which aligns the measures with the organizational unit of analysis. The study also interpreted effect estimates together with explanatory power instead of relying only on hypothesis acceptance. Because the design is cross-sectional and uses perceptual survey data, the results indicate theoretically consistent associations rather than definitive temporal causality. This limitation is addressed in the discussion and conclusion when interpreting managerial implications and future research needs.

3. RESULT AND DISCUSSION

3.1. Results

The final sample consisted of 200 SMEs. The sector distribution was led by food and beverage firms, followed by fashion and textile, craft and creative, services, and light manufacturing. The composition of the sample reflects SMEs operating in sectors that face different sustainability challenges, including food loss, packaging use, textile waste, energy consumption, material efficiency, and service-related resource use. Most participating firms had moved beyond the earliest start-up period, with 63% operating for three to ten years. The workforce profile was concentrated in the five-to-twenty employee range, indicating that the sample primarily represents small organizations with established operations but relatively limited managerial layers. Digital maturity was most commonly assessed at the intermediate level, while a smaller proportion reported advanced capability. Table 2 presents the characteristics of the sample.

Table 2. Sample characteristics

Variable	Category	Frequency	Percentage (%)
Sector	Food and beverage	60	30
Sector	Fashion and textile	50	25
Sector	Craft and creative	36	18
Sector	Services	30	15
Sector	Light manufacturing	24	12
Firm age	3-5 years	70	35
Firm age	6-10 years	56	28
Firm age	Other age groups combined	74	37
Workforce size	5-10 employees	64	32
Workforce size	11-20 employees	76	38
Workforce size	Other workforce sizes combined	60	30
Revenue level	Lower-middle	72	36
Revenue level	Middle	50	25
Revenue level	Other revenue levels combined	78	39
Digital maturity	Basic	76	38
Digital maturity	Intermediate	88	44
Digital maturity	Advanced	36	18

Source: Authors' calculations based on 200 survey responses collected in 2025 and processed in 2026.

The sample profile provides relevant context for interpreting the model. The dominance of basic and intermediate digital maturity indicates that the study does not focus only on highly digitalized SMEs but captures firms at different stages of capability development. The inclusion of both production-oriented and creative or service-based SMEs also allows green innovation to be examined in different forms. In production-oriented firms, green innovation may involve improvements in material and energy efficiency, whereas service and creative SMEs may adopt digital substitution, packaging redesign, logistics coordination, and other resource-conscious practices.

The measurement model was evaluated before the structural relationships were examined. Table 3 presents Cronbach's alpha, composite reliability, and average variance extracted (AVE) for the three constructs. All Cronbach's alpha values exceed 0.85, while all composite reliability values exceed 0.89. These values are above the recommended threshold of 0.70, indicating adequate internal consistency reliability. The AVE values range from 0.633 to 0.691 and exceed the recommended minimum value of 0.50, supporting convergent validity (Hair et al., 2019). Accordingly, digital intelligence, green innovation, and sustainable SME performance demonstrate sufficient reliability and convergent validity for structural model assessment.

Table 3. Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
Digital intelligence	0.879	0.910	0.669
Green innovation	0.854	0.896	0.633
Sustainable SME performance	0.887	0.918	0.691

Source: Data Processed (2026)

The measurement results also support the distinction among the three constructs used in the conceptual model. Digital intelligence represents the firm's capability to acquire, interpret, integrate, and apply digital information. Green innovation represents environmentally oriented improvements in products, processes, and managerial practices, while sustainable SME performance represents longer-term environmental, operational, and competitive outcomes. These constructs are therefore conceptually related but represent different stages in the proposed capability-conversion mechanism.

After establishing the adequacy of the measurement model, the structural relationships were assessed. The results are presented in Table 4. Digital intelligence positively influenced green innovation with a path coefficient of 0.597, supporting H1. Green innovation positively influenced sustainable SME performance with a coefficient of 0.333, supporting H2. Digital intelligence also had a positive direct effect on sustainable SME performance with a coefficient of 0.270, supporting H3.

The indirect effect of digital intelligence on sustainable SME performance through green innovation was 0.199. Because the indirect effect was supported while the direct relationship between digital intelligence and sustainable SME performance remained positive and supported, green innovation partially mediated the relationship. Therefore, H4 was also supported. These findings indicate that digital intelligence contributes to sustainable SME performance both directly and indirectly through green innovation.

Table 4. Structural model results

Hypothesis	Path	Coefficient (beta)	Decision
H1	Digital intelligence -> Green innovation	0.597	Supported
H2	Green innovation -> Sustainable SME performance	0.333	Supported
H3	Digital intelligence -> Sustainable SME performance	0.270	Supported
H4	Digital intelligence -> Green innovation -> Sustainable SME performance	0.199	Partial mediation

Source: Data Processed (2026)

The explanatory power of the structural model was evaluated using the coefficient of determination (R-squared). Digital intelligence explained 35.6% of the variance in green innovation. Digital intelligence and green innovation together explained 42.1% of the variance in sustainable SME performance. These values indicate that the model explains a meaningful proportion of variation in both endogenous constructs while leaving room for additional organizational and external factors that are not included in the present model.

Table 5. Coefficient of determination

Endogenous Variable	R-Squared
Green innovation	0.356
Sustainable SME performance	0.421

Source: Data Processed (2026)

The R-squared values should therefore be interpreted as evidence that digital intelligence and green innovation provide a substantive explanation of sustainable SME outcomes rather than a complete predictive model. Other factors such as environmental knowledge, leadership commitment, regulation, market demand, financial capacity, supplier capability, industry technology, and competitive conditions may also influence green innovation and sustainable SME performance.

3.2. Discussion

The positive relationship between digital intelligence and green innovation supports H1 and represents the strongest structural relationship in the model. This finding supports the dynamic capability argument that the value of digital capability lies not merely in technology possession but in the ability of firms to sense relevant information, seize emerging opportunities, and transform organizational routines (Teece, 2018; Teece et al., 1997). SMEs with stronger digital intelligence can obtain more timely information about customer preferences, resource consumption, process deviations, supplier alternatives, and operational bottlenecks. Such information improves the identification of environmental problems and can support responses through cleaner processes, reduced material use, improved packaging, or more resource-efficient production.

The finding is also consistent with research showing that analytics capability becomes valuable when data, technology, managerial skills, and organizational routines are combined (Gupta & George, 2016; Wamba et al., 2017). Digital information alone does not automatically generate environmental improvement. Its value emerges when managers interpret and use that information to redesign products, processes, and organizational practices. This result also extends digital entrepreneurship research, which has emphasized the role of digital platforms in entrepreneurial growth and network access (Cenamor et al., 2019; Nambisan, 2017), by showing that digital capabilities can also support environmentally oriented innovation.

The result of H1 has a practical implication for SME managers. Digital investment should not be evaluated only in terms of technology adoption but also according to whether digital information is used to identify and solve operational and environmental problems. Applications such as demand forecasting, production monitoring, resource tracking, and digital supplier information can provide a basis for reducing waste, improving resource efficiency, and developing environmentally oriented products and processes.

The positive effect of green innovation on sustainable SME performance supports H2 and is consistent with the natural resource-based view. The NRBV argues that environmentally oriented capabilities can create competitive value by improving resource productivity, reducing environmental risks, and supporting sustainable development (Hart, 1995; Hart & Dowell, 2011). Green innovation can therefore contribute to SME performance through several mechanisms. Process improvements that reduce energy or material consumption may lower recurring costs, while waste prevention can reduce losses associated with defects or obsolete inventory. Cleaner products and packaging may strengthen market acceptance, while environmental monitoring can improve the visibility of resource use and support continuous improvement. These mechanisms explain how green innovation can generate environmental as well as economic and operational benefits.

The finding is consistent with (Chen et al., 2006), who demonstrate that green innovation can strengthen corporate advantage, and (Xie et al., 2019), who link green process and product innovation with firm performance. It is also consistent with (Hizarci-Payne et al., 2021), who report a positive overall relationship between environmental innovation and firm performance. The present evidence extends these findings to SMEs in West Java, where green innovation may frequently involve incremental improvements rather than large research and development investments. Such incremental changes can nevertheless generate meaningful results when they are embedded in organizational routines and connected to measurable operational outcomes.

Accordingly, SMEs should not treat green innovation merely as a symbolic environmental or branding activity. Environmental initiatives should be linked with measurable operational outcomes such as reductions in material consumption, energy use, waste, production costs, and process inefficiencies. This interpretation is also consistent with the environment-competitiveness argument that well-directed environmental improvement can generate productivity gains (Porter & Linde, 1995).

The positive direct effect of digital intelligence on sustainable SME performance supports H3. This finding indicates that digital intelligence can contribute to sustainable performance even before it is converted into a formal green innovation. Better forecasting may reduce excess inventory, digital coordination can reduce unnecessary paperwork and activities, real-time communication can improve organizational responsiveness, and integrated digital records may improve control over purchasing, maintenance, and customer service. These outcomes are consistent with digital transformation research emphasizing that technology generates organizational value when it is incorporated into redesigned processes and strategic renewal rather than treated only as a technological investment (Bharadwaj et al., 2013; Verhoef et al., 2021; Vial, 2019).

However, the direct effect of digital intelligence on sustainable SME performance is smaller than its effect on green innovation. This pattern is theoretically important because it suggests that part of the sustainability value of digital capability is realized through an intermediate organizational response. Digital intelligence creates information and coordination capacity, while green innovation converts part of that capacity into environmentally oriented changes in products, processes, and managerial practices. A firm may therefore be digitally active yet obtain limited sustainability value if its digital tools remain disconnected from production, resource management, and environmental objectives.

The managerial implication of H3 is that SMEs should evaluate digitalization according to the outcomes created by digital capability rather than simply the number of technologies adopted. Digital investments are more likely to improve sustainable performance when they strengthen operational efficiency, coordination, responsiveness, resource control, and long-term competitiveness.

The mediation result supports H4 and provides a clearer explanation of the mechanism through which digital intelligence contributes to sustainable SME performance. The indirect effect of 0.199 indicates that green innovation carries part of the influence of digital intelligence on sustainable performance, while the continuing positive direct effect indicates partial rather than full mediation. This result is theoretically reasonable because digital intelligence can influence sustainable performance through several mechanisms. Green innovation is one mechanism, while digital capability may also improve customer responsiveness, financial control, supply-chain visibility, employee coordination, and operational resilience.

The mediation result also strengthens the integration of dynamic capability theory and the natural resource-based view. Dynamic capability theory explains how firms sense information, identify opportunities, and transform organizational resources, whereas the natural resource-based view explains how environmentally oriented capabilities and innovations can create sustainable value. The findings connect these perspectives sequentially: digital intelligence strengthens the firm's capacity to identify and implement change, green innovation directs part of this capability toward environmental improvement, and sustainable SME performance reflects the resulting environmental, operational, and competitive outcomes. This mechanism helps explain how general digital capability can be translated into sustainability-specific performance.

The partial mediation finding has an important managerial implication. Digital transformation and sustainability should not be managed as separate organizational agendas. Digital tools should be intentionally connected to green innovation objectives. Production dashboards can be used to monitor waste and scrap, forecasting systems can reduce overproduction, customer analytics can support the development of lower-impact products, and supplier information systems can assist in identifying recyclable or environmentally responsible materials. This alignment allows SMEs to transform digital information into measurable environmental and operational improvements.

Taken together, the results suggest that SME leaders should develop digital intelligence as an organizational capability rather than focus only on purchasing digital technologies. Digital investment should be accompanied by appropriate data use, employee capability, clear decision processes, and regular integration of digital information into operational decision making. The findings further suggest that digital initiatives should be explicitly linked to green innovation objectives and that SMEs should evaluate both the implementation of green innovation and its resulting environmental and business outcomes. These managerial recommendations are directly supported by the positive relationships among digital intelligence, green innovation, and sustainable SME performance and by the partial mediation identified in the structural model.

The findings also have implications for policy makers and SME-support institutions. Digitalization and sustainability should not necessarily be treated as separate development programs. Training, grants, and advisory programs can encourage integrated applications such as digital inventory systems for food-waste reduction, production analytics for material efficiency, traceability for responsible sourcing, and online market testing for sustainable products. Such programs can help SMEs connect capability development with measurable productivity and environmental benefits.

Finally, the context of the study should be considered when interpreting the findings. The sample consists of SMEs from different sectors in West Java and is concentrated primarily among firms with basic and intermediate levels of digital maturity. The findings are therefore particularly relevant to SMEs that are still developing their digital capabilities. The relationships may differ in highly technology-intensive industries, microenterprises with very limited digital resources, or large firms with specialized technology and sustainability functions. Nevertheless, the diversity of sectors represented in the sample indicates that the proposed capability-conversion mechanism is not limited to a single type of SME activity.

4. CONCLUSION

This study examined how digital intelligence contributes to sustainable SME performance and whether green innovation mediates this relationship. The findings show that digital intelligence positively influences green innovation and sustainable SME performance, while green innovation also contributes positively to sustainable SME performance. Green innovation partially mediates the relationship between digital intelligence and sustainable performance, indicating that digital capability creates value both directly through improved coordination, efficiency, and responsiveness and indirectly when it is translated into environmentally oriented product, process, and managerial innovation. The findings therefore suggest that SMEs should not treat digitalization and sustainability as separate initiatives. Instead, digital capabilities should be deliberately connected to resource efficiency, waste reduction, cleaner production, and other green innovation activities that can strengthen long-term operational, environmental, and competitive performance.

This study has several limitations. The cross-sectional design captures relationships at a single point in time and therefore cannot fully establish the temporal sequence among digital intelligence, green innovation, and sustainable SME performance. The study also relies on owner or manager perceptions and focuses on SMEs in West Java, which may limit the generalizability of the findings to other regions, industries, or organizational contexts. Future research should employ longitudinal and multi-source designs, include objective measures of environmental and operational performance, and test the proposed model across different regions and industry settings. Further studies may also incorporate external and organizational factors such as regulation, market demand, access to finance, supply-chain pressure, environmental uncertainty, and leadership commitment to provide a more comprehensive explanation of sustainable SME performance.

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