Digitalization of MSME in Green Campaign Activities, Supply Chain, and Quality Control:
Do They Support SDG Performance?

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ABSTRACT

While making a significant contribution to the country's economy, Micro, Small, and Medium Enterprises (MSMEs) in Indonesia are being challenged by the era of digitalization. Additionally, they are also encouraged to contribute to the achievement of the Sustainable Development Goals (SDGs). Their participation in both digitalization and the SDGs can serve as a pathway to building a competitive advantage. This study examines the impact of digitalization in green campaigns, supply chains, and quality control on the SDG performance of MSMEs. Data were collected through questionnaires administered to 414 MSMEs in East Java Province, Indonesia. The findings suggest that, for early-stage MSMEs, the digitalization of green campaigns positively affects SDG performance. In contrast, digitalization in supply chains and quality control does not show a significant effect on SDG performance. These results indicate that MSMEs are beginning to engage with global trends and issues through their shop-floor activities, despite limited resources, i.e., by promoting green initiatives via social media. This highlights the importance of providing training for MSME managers to become more digitally savvy and knowledgeable about sustainability, enabling them to overcome constraints and strengthen their competitive advantage.

KEYWORDS

Sustainable Development Goals, Digitalization, Indonesia, Early-Stage Company, Green Campaigns

INTRODUCTION

Business sustainability and change have become an essential element of a sustainable future, and almost every organization has begun adapting to a more sustainable model to keep up with the trends of the industry and the increased awareness of consumers (Agyabeng-Mensah et al., 2020; Fok et al., 2023). With the various issues surrounding environmental pollution, organizations are discovering that the implementation of sustainable green practices is a must. It is not just large corporations undergoing this shift, but even Micro, Small, and Medium Enterprises (MSMEs) are

exploring means of implementing sustainability into their operations (Abbas & Sağsan, 2019; Fok et al., 2023). The phrase "Sustainable Green Practices" is becoming a fixture of boardrooms, as both practitioners and management researchers alike recognize the importance of this phenomenon to multiple stakeholders (e.g., Afum et al., 2020; Agyabeng-Mensah et al., 2020; Baah et al., 2021; Fok et al., 2023; Nikseresht et al., 2024; Yacob et al., 2019). Sustainability is no longer an option for MSMEs, but rather an essentiality driven by customer expectations and keeping viability amidst competition in the long run.

It has been widely acknowledged that the majority of MSMEs face various limitations in their business, such as inadequate capabilities and limited resources (e.g., Cong et al., 2024; Dasaraju & Tambunan, 2019; Li et al., 2018; Meier et al., 2025; Sopha et al., 2021). However, this informal sector has become the backbone of the developing country's economy, such as Indonesia (e.g., Asian Development Bank, 2024; Kementerian PPN/Bappenas & UN Global Pulse, 2022). Therefore, the Government implements a six-aspect holistic approach to enhance the role of MSMEs, including policy, financial access, markets, human resource capacity, mentoring, and culture (e.g., Asian Development Bank, 2024; International Labour Organization, 2019; Rafiki et al., 2023; Surya et al., 2021).

At the same time, efforts to combine the six aspects and accelerate development programs require adequate information technology facilities, one of which is digitalization. Digitalization is inevitable and plays an essential role in accelerating MSME development programs through activities, such as improving MSME management, increasing efficiency and effectiveness in the supply of raw materials and distribution of production results, improving product quality, and increasing the role of MSMEs. These activities, in turn, contribute to the Sustainable Development Goals (SDGs) (Dasaraju & Tambunan, 2019).

Since the Indonesian Government has encouraged the role of digitalization for MSMEs, the data from the Ministry of Cooperatives and MSMEs shows that in 2022, there has been an increase in the number of MSMEs that enter the digital ecosystem, reaching 20.76 million or 26.6% of the number of MSMEs. In the first half of 2024, the number has reached 25.2 million MSMEs in the ecosystem (Antara News, 2024). Some studies revealed that training on the use of digital media in developing MSMEs has proven useful and can increase the knowledge and skills of MSME managers, overcoming the resource-based constraints (Meier et al., 2025; Raharja & Natari, 2021). In addition to the government's support and efforts to strengthen MSMEs' resilience, the COVID-19 pandemic has had an important role in "forcing" change in MSMEs' operations and strategy amid the crisis (Akpan et al., 2022; Oikawa et al., 2025; Takeda et al., 2022).

This study focuses on investigating the relationship between three aspects: green practice, digitalization, and performance in MSMEs. The existing literature has primarily focused on the factors affecting the digitalization of MSMEs (Omrani et al., 2024; Takeda et al., 2022; Tang et al., 2018) and how digitalization affects performance (Hassan et al., 2024; Oikawa et al., 2025; Wang & Esperança, 2023; Z. Zhao et al., 2025). There is a limited understanding of how the efforts that MSMEs have made to utilize digitalization in their green-based operations affect more comprehensive areas of performance, i.e., SDG-related performance. This study aims to investigate the role of digitalization in three MSMEs' operational activities, including green campaigns (marketing), supply chains, and quality control on SDGs performance. By relying on the resource-based view, this study is intended to provide the landscape of the role of digitalization in MSMEs' activities in pursuing the SDGs, which are not only the nation's goals but also the world's.

Based on a survey of 414 MSMEs in East Java Province, Indonesia, this study confirms that digitalization in the green campaign is positively associated with the SDG performance. However, the study finds no support for the effect of digitalization in supply chain and quality control on SDG performance. The practice of digitalized green campaigns provides insights into how MSMEs can scale their sustainability efforts.

This study offers several contributions. *First*, it adds to the literature on sustainable performance by examining the underexplored effect of digitalizing key processes in MSMEs' activities in alignment

with the SDGs. While previous research has largely focused on factors affecting the digitalization of MSMEs and the effects on MSMEs' performance, this study highlights which process has been most effectively optimized by MSMEs through green-based digital measures and contributes to their SDG performance. *Second*, this study extends the existing literature on MSMEs' environmental awareness by documenting the practice of green campaigns implemented by micro businesses. It demonstrates that these businesses have not only heightened their awareness of environmental challenges but also taken proactive steps to align economic and environmental considerations. This contributes to the growing body of research on grassroots sustainability efforts, showing that despite the limited resources and capabilities, MSMEs can leverage digitalization for environmental practices. This shows that providing relevant training for MSMEs can overcome their resource-based issues (Meier et al., 2025; Purnomo et al., 2024), which highlights the significant role of the Government and relevant parties in the pursuit of MSMEs' digitalization and SDGs agenda (Purnomo et al., 2024; Ullah et al., 2023). *Third*, this study offers practical guidance for MSME managers by suggesting ways to begin engaging with SDG practices through low-cost initiatives such as digital marketing. This study underscores that SDG involvement is not exclusive to large corporations or governments, but is achievable at all levels of business.

The remainder of the paper is organized as follows: the next chapter presents the Literature Review and Hypothesis Development. This is followed by Method, Results, and Discussion chapters. Finally, Conclusions, Limitations, and Suggestions are presented at the end of the paper.

Literature Review and Hypothesis Development

Resource-Based View Theory

Resource-Based View (RBV) theory is a theory initiated by Wernerfelt (1984) and developed by Barney (1991). RBV is an approach to achieving competitive advantage that explains that internal resources are more critical for a company than external resources in attaining and maintaining competitive advantage. The three main scopes that focus on this theory are physical, human, and organizational resources, namely that all three help exploit opportunities and reduce threats to company development (David & David, 2017). Organizational capability is central to building a strategic competitive advantage, and the resources behind it must be valuable, rare, inimitable, and non-substitutable (Sarkis et al., 2021). Appropriate and effective resource management can influence the performance of MSMEs (Benzidia & Makaoui, 2020). These MSME capabilities are illustrated through the effective use of technology to facilitate decision-making, understand customers better, and benefit from improved performance.

Based on the RBV, companies have a higher chance of success if they have the best and most appropriate resources for their business and strategy (Collis & Montgomery, 2008). This is because the quality of resources will determine the company's effectiveness and efficiency in carrying out functional activities. A company obtains a competitive advantage through a combination of valuable, rare, inimitable, and non-substitutable resources and capabilities under its control (Barney et al., 2001). This theory also explains the finding that the level of digitalization of MSMEs itself is positively affected by three antecedents, including information technology, skills, and digital strategy, which in turn, can determine the level of performance (Eller et al., 2020). Through digitalization, the MSMEs can gain a competitive advantage to provide value to the customers (Chaudhuri et al., 2022), and participate more in the green efforts and SDGs (Jibril et al., 2024). In other words, the more MSMEs adopt digital technologies, the more they prioritize sustainability goals in their business (Jibril et al., 2024; Santos & Sant'Anna, 2024), which can further affect their overall performance.

Sustainable Development Goals (SDGs)

SDGs are ideas of the United Nations that contain 17 sustainable development goals with 169 integrated and inseparable targets. These goals and targets are expected to have an impact starting 1 January 2016 and will be valid for 15 years until 2030 (United Nations, 2015). According to

Indonesia's SDGs roadmap, the main SDGs target recommendations include free primary and secondary education, double energy efficiency, universal health coverage, and increased renewable energy. In addition, other policies that are considered necessary for accelerating the achievement of the SDGs are expanding access to urban housing and basic services, providing adequate drinking water, reducing poverty, eradicating epidemic diseases, and increasing access to energy, as well as increasing the income of people experiencing poverty (Kementerian PPN/Bappenas, 2019).

Figure 1. All 17 SDGs Goals

Several existing research studies point out the role of MSMEs in achieving the SDGs. First, MSMEs are significant contributors to Gross Domestic Product (GDP), job creation, total exports, achievement of SDGs, and green development (Lopes de Sousa Jabbour et al., 2020). Second, based on their level of importance, MSMEs are advised to participate in green supply chain practices and the SDGs (Ilyas et al., 2020). This is because previous research found that MSME management support significantly influences the SDGs, especially with support from the Government (Ullah et al., 2023). Third, MSMEs contribute to a country's SDGs through job creation, poverty alleviation, and increasing living standards (Endris & Kassegn, 2022). In general, MSME participation significantly contributes to the country's achievement of the SDGs.

Meanwhile, digitalization also accelerates efforts to achieve the SDGs. Onyango & Ondiek (2021) found that limited mastery of information-communication technology skills and personnel training can hinder the implementation of the SDGs. In other words, a better level of technological literacy in an institution can increase the chances of achieving the SDGs. Studies state that digitalization is useful as a catalyst for the transition towards sustainable practices (Gregori & Holzmann, 2020; Mondejar et al., 2021; Ozturk et al., 2024), especially in environmental and economic aspects (Brenner & Hartl, 2021).

The Role of Digitalization in MSMEs

Digitalization in MSMEs has an impact on various aspects of their operations, including the level of workforce requirements (Takeda et al., 2022), financial performance (Eller et al., 2020; Meier et al.,

2025), and strategy (Proksch et al., 2021). Hervé et al. (2020) state that digitalization has a positive impact on the scope of a company's essential areas, which include costs, accessibility, resources, and competencies; market knowledge; distance and location; as well as relational competencies and partnership networks, which ultimately lead to greater orientation and opportunities for market internationalization (Hervé et al., 2020). However, previous research believes that MSMEs are relatively less prepared than large companies to handle technological disruption due to limited environments and resources (e.g., Cong et al., 2024; Dasaraju & Tambunan, 2019; Li et al., 2018; Meier et al., 2025; Sopha et al., 2021).

Each digitalization phase has corresponding resources, structures, growth strategies, metrics, and goals (Verhoef et al., 2021). The size of the MSME was found to influence store digitalization and information technology management competence; namely, the larger the size of the MSME, the more sophisticated the level of digitalization in the store and the better the management quality (Buer et al., 2021). Digital strategy, as the beginning of digitalization in MSMEs, is an important indicator for determining the quality of services/products and digital processes through the mediating role of digital capabilities and digital culture (Proksch et al., 2021). Thus, the planning stage is a crucial factor to pay attention to in the digitalization process in MSMEs, which involves various resources (Proksch et al., 2021). According to the RBV, there are three resources for MSMEs in the digitalization process: information technology, employee skills, and digital strategy (Eller et al., 2020; Kallmuenzer et al., 2024).

Based on the level of digitalization, Dutta et al. (2021) group digitalization by MSMEs into five levels. In the conventional to intermediate stages, there is Level 1, namely the use of paper-based, Level 2 represents the use of spreadsheets, and Level 3 represents the use of systems provided commercially or customized. Meanwhile, at the advanced level, Level 4 uses Product Lifecycle Management (PLM), and Level 5 uses closed-loop and integrated PLM. In general, the more digitally advanced MSMEs are the more likely they are to advance their engagement in green efforts, indicating the complementarity between both (Kesidou et al., 2025) and further affecting performance.

Green Campaign in MSMEs

Green campaigns are defined as efforts and media to expose environmental issues to the public and, at the same time, also instill awareness of 'green' behavior towards the environment. Green campaign efforts are also carried out to show that businesses care about economic aspects and maintain environmental sustainability, which is hereafter referred to as the green economy (Pangarso et al., 2022).

Green campaign practices can be represented through various business activities, which include green manufacturing, green supply chain, and green marketing practices. Previous research found that green practices in companies have a good impact on sustainable performance, including economic performance, environmental performance, and social performance (Afum et al., 2020).

Two factors are the drivers of the implementation of green practices. In research on green manufacturing (Ghadimi et al., 2021), these internal factors consist of investment in technology and innovation, organizational culture, low production costs, and stakeholder flexibility. Meanwhile, external factors include promotion and regulation by the Government, development of waste management, increased logistics facilities, and pressure from the market.

Apart from the factors driving the implementation of green manufacturing, this effort is also not free from obstacles. Karuppiah et al. (2020) stated that choosing a location for delivery, sustainable supply chain management, driver quality, supplier performance, and supplier selection are several obstacles and challenges in implementing green manufacturing. These aspects may be more apparent to MSMEs, given that the size and capabilities are not as well established as those of larger companies.

Supply Chain in MSMEs

The supply chain is the key to the continuity of providing products and/or services to a company. Recent research concludes from a literature review that there are four critical areas in the MSME supply chain, namely the role of collaboration and culture, the role of MSME capabilities, information systems, and costs and funding (Bak et al., 2023). If MSMEs can manage and maintain these four aspects well, their resilience can be maintained even in times of crisis, such as a pandemic.

Digitalization of the supply chain refers to the evolution towards a more innovative model involving digital technology that improves the ability to optimize planning, sourcing, and procurement strategies (Bigliardi et al., 2022). The benefits of adopting digitalization technology are also primarily obtained from increased performance expectations, cost-effectiveness, and trust (Zaman et al., 2022). Research shows that supply chain integration has a mediating role in the influence of digital technology on corporate resilience and that this impact becomes stronger when information complexity is high (Cui et al., 2022). This further raises a question on the effect of the nexus between digitalization and green orientation in supply chain management (Sarkis et al., 2021).

Quality Control in MSMEs

Quality control is an effort to reduce costs to maintain quality. ISO 9001 defines quality as the degree to which inherent characteristics meet requirements. In other words, ensuring the quality of a product or service is to ensure that its value is met satisfactorily for the end customer. To ensure overall quality, processes, products, machines, equipment, and systems must meet statutory and contractual quality requirements. Quality costs are incurred to handle the quality of the products produced, maintain quality, and repair defective products or those that do not meet standards. These costs consist of four types, namely prevention costs (during the production process) to prevent product failures, appraisal costs (post-production) to detect product failures, internal failure costs (post-production), and external failure costs (post-sales). To compensate for product failures (Blocher et al., 2019). Failure costs are the most significant and dangerous risk because they can reduce the company's image and credibility, potentially reducing market share. Therefore, the entity has made several efforts to reduce these costs.

Dutta et al. (2021) offer a quality control mechanism through the PDCA (Plan, Do, Check, and Action) mechanism. At the planning stage, the planning process drives continuous improvement to reduce the risk of product change (Chhim et al., 2019). Quality is an objective measure of the promises made by manufacturing MSMEs to their customers through the products they supply (Ji et al., 2019). All of this is set to change with manufacturers embracing mass customization. Quality practices must increasingly facilitate decisions based on information gathered in real-time.

More specifically, according to Dutta et al. (2021), in the Do stage of the PDCA cycle, the action plan intended to be implemented is designed, which is often the case in manufacturing functions. Relevant information is selected and documented, including extraordinary events and their implications. The Check stage is carried out by running trials and analyzing the production process. Digital integration with business systems, such as PLM and ERP, provides two-way functionality to upload data used for reports and decision-making, as well as to obtain data and facilitate process monitoring. The Act stage of the PDCA cycle involves implementing and standardizing the broader improvements. It means documenting results, informing if there are changes to the process, and making recommendations for standardization. This stage calls for escalation in the event of failure to meet deadlines and the need for corrective action to be implemented. Disparities arise due to a lack of coordination between digitized manufacturing processes and less efficient paper-based quality processes. Therefore, the impact of digitalization at the Act stage is supplier integration, warranty management, customer communication management, and audit.

Digitalization of the Green Campaign and SDGs Performance of MSMEs

The issue of sustainability in the manufacturing industry has become an important topic of discussion in various countries. It encourages the industry to focus on economic profits and better appreciate the need to protect the environment by carrying out manufacturing processes more efficiently (Afum et al., 2020). This system is often referred to as green manufacturing. In theory, green manufacturing is an efficient method that utilizes inputs to produce little or no pollution and eliminates waste to reduce negative ecological impacts significantly (Karuppiah et al., 2020). Green manufacturing practices are one of the practices of the green campaign. Khanra et al. (2022) stated that green campaigns can become a competitive advantage while contributing to sustainable development. This is because green campaigns have the potential to overcome the dilemma between consuming available resources and saving them for the future.

Based on the RBV, ownership of quality resources can increase functional efficiency and effectiveness to achieve this competitive advantage. In line with the theory, several previous studies have found that green campaigns positively affect company performance (Afum et al., 2020; Karuppiah et al., 2020). In the context of MSMEs, green campaigns are predicted to improve various performances included in the SDGs' performance components (Oduro & Matarazzo, 2025; Pangarso et al., 2022). MSMEs that implement green campaigns can effectively enhance their environmental and social outcomes. The results of this adoption can optimize manufacturing processes, reducing negative environmental impacts. However, they can also improve organizational members' and society's quality of life (Afum et al., 2020). In the era of society 5.0, MSMEs are also increasingly influenced by digital technology in running their business. Implementing the Digital Green Campaign (DGC) by MSMEs can encourage managers to run their businesses in a more environmentally friendly way to align with the green economy concept (Pangarso et al., 2022). Bouwman et al. (2019) explain that the role of digitalization in MSME business processes would encourage the emergence of innovation in business models, which is reflected in organizational strategy. Tajudeen et al. (2019) proved that business model innovation by utilizing digital technology can improve performance.

Based on the RBV and the results of previous research, it is predicted that DGC will improve the SDGs' performance of MSMEs. Meanwhile, when the digital green campaign is not carried out optimally, the SDGs performance of MSMEs tends to be negatively impacted. Thus, the first hypothesis in this research is:

H_1: Digitalization of green campaigns has a positive effect on the SDGs performance of MSMEs

Digitalization of the Supply Chain and SDGs Performance of MSMEs

One of the digital transformation forms is the digitalization of supply chain channels (Guo et al., 2020). Digital supply chain (DSC) involves the development of information systems and the adoption of innovative technology that enhances supply chain integration and agility. This, in turn, improves customer service and overall organizational performance (Ageron et al., 2020). DSC creates value for organizations by enabling technology integration, fostering customer focus, and reducing intra- and inter-organizational costs. DSC provides more visibility into material flows along the value chain and real-time information to make accurate and timely decision-making (Ageron et al., 2020). As a result, DSC implementation promotes efficiency and effectiveness in delivering value to stakeholders, primarily customers, while supporting organizational performance goals such as revenue, profit, market share, product quality, responsiveness, and sustainable capabilities.

Drawing on RBV, prior studies indicate a positive relationship between DSC implementation and firm performance (Afum et al., 2020; Ageron et al., 2020; Sarkis et al., 2021). More specifically, DSC enhances cost performance by improving efficiency, optimizing costs, and maintaining competitiveness (Barney, 1991; Chatterjee et al., 2024; Porter & Heppelmann, 2015), which are key aspects in the pursuit of

sustainability. In addition to the technology adoption, MSMEs are increasingly embracing green supply chain management, which further contributes to their competitive advantage and performance (Naimat & Davies, 2025; Zhao et al., 2023). Therefore, while DSC implementation depends on an organization's goals and strategies (Ageron et al., 2020), combining green-based objectives with DSC practices can strengthen MSMEs' position, enhance performance, and support their contributions to sustainability, aligning them with SDG goals.

In sum, DSC is predicted to positively correlate with the MSMEs' SDGs performance. Thus, if DSC is not integrated optimally, the performance of MSMEs' SDGs is lower. Thus, the second hypothesis in this research is:

H_2: Digitalization of the supply chain has a positive effect on the SDGs performance of MSMEs

Digitalization of Quality Control and SDGs Performance of MSMEs

Organizational digital transformation can increase responsiveness in meeting customer needs. From the Industrial Revolution 4.0 perspective, digitalization of organizational quality control activities is a priority, as it is an integral part of the customer value proposition. Digitalization in quality control, or so-called digitalized quality control (DQC), is the digital control of objective measures of promises made by organizations to customers through the products produced or supplied (Dutta et al., 2021). With DQC, MSMEs can mitigate product risks when carrying out design, production, and supply activities for customers, as well as innovative variations in determining production times and costs that meet customer needs. The increased use of digital technology in product development creates a gap between digital-based and paper-based or manual quality control processes. In practice, DQC is the application of the four stages of the PDCA cycle in digital technology and digital product development by MSMEs. Implementing PDCA in digital manufacturing processes and integrating it with digital product development can make the quality control process more responsive and efficient (Dutta et al., 2021; Parviainen et al., 2017), thereby improving the performance of MSMEs (Dutta et al., 2021).

This study predicts a positive effect of DQCs on SDGs performance, as the adoption of digitalization in the quality control process can improve the quality of the company's performance. Based on RBV theory, a company will increasingly achieve its highest chance of success if it has the best and most appropriate resources for its business and strategy (Collis & Montgomery, 2008). Some studies mention the specific practices of DQC, such as the use of technology to conduct large-scale inspections of food products (Tancredi et al., 2024; Tortorella et al., 2025) and using CCTV technology to capture product defects (Jan et al., 2023). Compared to manual process, the use of such digitalized process in the quality control accelerates the completion of the production final process and results in greater performance. More specifically related to SDGs performance, the efficiency and effectiveness created by the DQC, for example, can help MSMEs to optimize the product quality with a lower environmental impact and enable continuous improvement towards greener standards (Jan et al., 2023; Liu, 2025; Santos & Sant'Anna, 2024).

Overall, based on theory and previous research results, this research proposes that when MSMEs implement DQC in the manufacturing process, the SDGs performance will improve. Meanwhile, if DQC is not carried out optimally, it can weaken or reduce the performance of MSMEs' SDGs. Thus, the third hypothesis in this research is:

H_3: Digitalization of quality control has a positive effect on the SDGs performance of MSMEs

In general, the framework of this research is depicted in Figure 2:

Figure 2. Research Framework
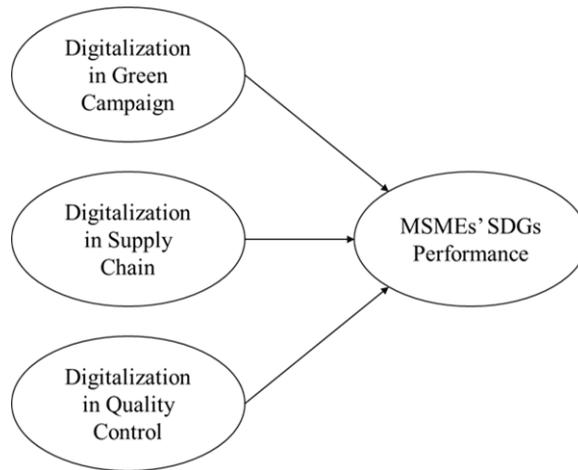
Research Methods

Research Design

This research employs a quantitative method by collecting data through questionnaires from 414 MSMEs in East Java. Based on the total population of MSMEs operating in East Java Province, the research sample was determined using the quota sampling method by region. This technique enables the determination of the number of samples required from each category. It ensures that the samples represent the population proportionately and are balanced (Yang & Banamah, 2014). Given the heterogeneous demographics, quota sampling ensures that all the subgroups within the population (i.e., MSMEs in East Java Province) are adequately represented in the sample (Sekaran & Bougie, 2016; Sudman, 1966). In this study, the quota proportions were established to achieve adequate representation from three categories of regional gross MSME growth: high, medium, and low. Respondents from two cities (Surabaya and Mojokerto) represent the high-growth category, while the remaining regions represent the medium- and low-growth categories.

Research Subject

The research subjects, in this case, are MSMEs in East Java. MSMEs in East Java are defined as micro, small, and medium-sized business units that operate in the East Java Province area and meet the criteria set by the Government. According to the Indonesian Ministry of Cooperatives and SMEs, MSMEs in East Java are defined as businesses that meet the criteria in Table 1.

The characteristics of MSMEs in East Java are very diverse and classified based on the industrial sector and company scale. Most MSMEs in East Java operate in the food and beverage, textile and clothing, handicraft, and creative industries. Having significantly contributed to regional economic development, MSMEs in East Java are declared an influential economic resource. MSMEs contributed 57.25% to the Gross Regional Domestic Product (GRDP) in 2020 and increased by 0.56% to 57.81% in 2021 (Cooperatives and Small and Medium Enterprises Office of East Java Province, 2022).

Table 1. Classification of MSMEs

Type of business	Asset	Annual income per year
Micro business	≤ IDR 50 M	≤ IDR 300 M
Small business	IDR 50 M – 500 M	IDR 300 M – 2.5 B
Medium business	IDR 500 M – 10 B	IDR 2.5 B – 50 B

Source: Cooperatives and Small and Medium Enterprises Office of East Java Province (2022); Indonesian Government (2008)

The significant increase in internet use by MSMEs in East Java shows that the digital transformation process has been going well. In 2016, of all MSMEs in East Java, 11% had used the internet, while 89% still did not use it in their business operations. Significant changes will occur in 2021, based on survey results showing that 44% of MSMEs in East Java have utilized the internet in their business processes (Cooperatives and Small and Medium Enterprises Office of East Java Province, 2022). Based on data attached to the East Java Government webpage, almost 50% of the MSME population in East Java has utilized technology or digitalization in their business cycle.

Operational Definition and Variable Measurement

The concept of MSMEs' SDG performance refers to the efforts of MSMEs to contribute to achieving the SDGs. The large number of MSME workforce absorption in various countries is vital in achieving inclusive and sustainable economic growth (Dalton, 2020). Adopting the measurement of sustainable performance from several previous studies (Abdul-Rashid et al., 2017; Hami et al., 2015; Sezen & Çankaya, 2013), the MSMEs' SDGs' performance variable is based on three main factors: economic performance, environmental performance, and social performance. Each indicator is measured on a Likert scale ranging from 1 *"strongly disagree"* to 5 *"strongly agree."*

The green campaign is an effort by MSMEs to support increasing awareness of the importance of protecting the environment and encouraging sustainable action. The green campaign variable covers several aspects, including green marketing, packaging, manufacturing, and environment, which encourage MSMEs to produce environmentally friendly business activities. The measurement of the green campaign is based on the instruments of several previous studies (Afum et al., 2020; Moslehpour et al., 2021), which have measured aspects related to the green campaign. The instrument will be measured on a 5-point scale, indicating that the larger the scale, the more integrated the level of digitalization.

Supply chain refers to a series of network processes of suppliers, distributors, inventory storage cycles, and transportation that connect producers and final consumers, intending to meet consumer needs efficiently and effectively. The supply chain measurement is based on the instrument from Singh & Kumar (2020), which measures supply chain strategies in small and medium-sized business units. Measuring the level of digitalization in the supply chain is projected on a supply chain variable indicator measurement scale, with a 5-point Likert scale, with points 1 for the simplest digitalization process and 5 for the integrated process.

Technology implementation can influence the quality control process to create a sustainable business. The process must be adapted to technological developments to develop and implement timely corrective actions and optimize product development. The measurement of quality control variables refers to instruments from Dutta et al. (2021) which test Plan-Do-Check-Act in the quality control cycle using a digital approach.

Data Analysis Technique

Statistical analysis in the quantitative approach was carried out using partial least squares structural equation modeling (PLS-SEM) via SmartPLS. PLS-SEM is an analytical tool recognized and

widely used in business research, especially in operations and supply chain management research (Peng & Lai, 2012). PLS-SEM is considered an appropriate predictive analysis tool in explanatory research to handle complex predictive relationships (Bodoff & Ho, 2016). PLS-SEM helps measure the extent to which certain parts of the research model accurately predict values from other parts of the research model (Hair et al., 2019).

Results and Discussions

Descriptive Statistics

A total of 414 MSME actors have completed the survey. Each region was supposed to provide about 30 to 50 data points, except for Surabaya, the province's capital city, and Mojokerto, a city in East Java. Both cities have a greater number of MSMEs. Only one data point was dropped due to incomplete data. Table 2 shows the descriptive statistics of the respondents.

Table 2. Descriptive Statistics

Details	n	Percentage
Respondent's Gender		
Male	45	10.87%
Female	369	89.13%
Total	**414**	**100.00%**
Respondent's Education		
Master	8	1.93%
Bachelor	110	26.57%
Diploma	36	8.70%
Senior High School	234	56.52%
Below Senior High School	26	6.28%
Total	**414**	**100.00%**
MSME Age		
1 to 3 years	136	32.85%
>3 to 5 years	108	26.09%
>5 to 10 years	117	28.26%
>10 to 15 years	37	8.94%
>15 years	16	3.86%
Total	**414**	**100.00%**
MSME Region		
Bojonegoro Regency	44	10.63%
Gresik Regency	49	11.84%
Mojokerto City	65	15.70%
Ponorogo Regency	49	11.84%
Sumenep Regency	39	9.42%
Surabaya City	125	30.19%

Table 2. Continued

Details	n	Percentage
Tuban Regency	43	10.39%
Total	**414**	**100.00%**
Industry		
Fashion	20	4.83%
Culinary/food and beverage	335	80.92%
Creative products	44	10.63%
Other	15	3.62%
Total	**414**	**100.00%**

The majority of the respondents are female (89.13%) since most of the MSME actors are productive housewives. For the educational aspect, most MSMEs have been run by senior high school graduates (56.52%) and bachelor's degree holders (26.57%). Furthermore, MSMEs are mostly in the early stage, with 87.20% having operated for less than ten years. Based on the industry, culinary/food and beverage MSMEs dominate the respondents.

Analysis

Table 3. Validity Test Results

Code	Details	Loading Factor	Loading Factor After Elimination	α	CR	AVE
	SDG Performance			**0.776**	**0.847**	**0.529**
SDG1	Increase in profit	0.601	0.819			
SDG2	Increase in market share	0.564	0.785			
SDG3	Increase in assets	0.588	0.766			
SDG4	Decrease in electricity usage	0.406	-			
SDG5	Decrease in the use of environmentally unfriendly materials	0.480	-			
SDG6	Reduction in odorous waste and oil waste	0.510	-			
SDG7	Improvement in workplace safety	0.557	-			
SDG8	Support for the surrounding community	0.598	-			
SDG9	Solid work environment	0.585	0.586			
SDG10	Improved relationships with the community and clients	0.640	0.653			
	Digitalization of Green Campaign			**0.311**	**0.742**	**0.591**
GC1	Utilization of tools to promote eco-friendly products	0.769	0.713			
GC2	Utilization of tools to promote eco-friendly product packaging	0.585	-			
GC3	Utilization of tools to support eco-friendly payments	0.707	0.821			

Table 3. Continued

Code	Details	Loading Factor	Loading Factor After Elimination	α	CR	AVE
GC4	Digitalization in product design	0.473	-			
GC5	Digitalization in supplier certification for ISO 14000	0.360	-			
GC6	Digitalization in the use of eco-friendly products by owners and/or employees	0.439	-			
Digitalization of Supply Chain				**0.924**	**0.935**	**0.646**
SC1	The use of tools to minimize product delivery time	0.562	-			
SC2	The use of tools to minimize production costs	0.765	0.773			
SC3	The use of tools for accurate supply and demand	0.878	0.885			
SC4	The use of tools to minimize rejection rates	0.923	0.932			
SC5	The use of tools for human resource management	0.896	0.887			
SC6	The use of tools to minimize product delivery time	0.755	0.759			
SC7	The use of tools in the forecasting process	0.716	0.715			
SC8	The use of digital tools in the planning process	0.736	0.764			
SC9	The use of digital tools in vendor management	0.684	0.677			
SC10	The use of digital tools in logistics design	0.599	-			
SC11	The use of digital tools in Customer Relationship Management (CRM) activities	0.417	-			
SC12	The use of digital tools in pricing determination activities	0.596	-			
Digitalization of Quality Control				**0.973**	**0.975**	**0.753**
QC1	The use of digital tools in program management	0.448	-			
QC2	The use of digital tools in quality design	0.426	-			
QC3	The use of digital tools in dimensional variance analysis	0.368	-			
QC4	The use of digital tools in failure analysis and its impact	0.474	-			
QC5	The use of digital tools in process flow charts, inspection planning, and control planning	0.507	-			
QC6	The use of digital tools in production part approval processes	0.508	-			

Table 3. Continued

Code	Details	Loading Factor	Loading Factor After Elimination	α	CR	AVE
QC7	The use of digital tools in standards compliance	0.378	-			
QC8	The use of digital tools in general standards compliance	0.798	0.747			
QC9	The use of digital tools in inbound and outbound goods control	0.782	0.743			
QC10	The use of digital tools in industry recognition and identification	0.816	0.803			
QC11	The use of digital tools in production supervision and monitoring	0.885	0.876			
QC12	The use of digital tools in inspection implementation	0.857	0.853			
QC13	The use of digital tools in statistical process control	0.844	0.864			
QC14	The use of digital tools in supplier quality management	0.821	0.836			
QC15	The use of digital tools in dimensional validation	0.941	0.949			
QC16	The use of digital tools in defective product tracking and non-conformity management	0.876	0.885			
QC17	The use of digital tools in audit management	0.896	0.917			
QC18	The use of digital tools in management issues and CAPA (Corrective and Preventive Actions)	0.931	0.950			
QC19	The use of digital tools in complaint management	0.906	0.911			
QC20	The use of digital tools in quality dashboards, KPIs, and continuous improvement	0.906	0.918			

Table 4. Discriminant Validity Test Results

	Heterotrait-monotrait ratio (HTMT)
Quality Control ↔ Green Campaign	0.533
SDGs Performance ↔ Green Campaign	0.424
SDGs Performance ↔ Quality Control	0.099
Supply Chain ↔ Green Campaign	0.366
Supply Chain ↔ Quality Control	0.375
Supply Chain ↔ SDGs Performance	0.110

Table 5. Multicollinearity Test Results

Variables	VIF
Green Campaign → SDGs Performance	1.091
Quality Control → SDGs Performance	1.190
Supply Chain → SDGs Performance	1.141

Table 3 presents the data of the inner model results. This research used 48 items of questionnaires. Validity and reliability tests were conducted for each indicator, which formed latent variables or constructs of the study. Validity tests for the indicators and variables consist of two types: convergent validity and discriminant validity. The results of the convergent validity test are interpreted by the AVE (Average Variance Extracted) values, where all variables show values above 0.50, and each indicator of the latent variable shows factor loadings above 0.70. Eliminations of some indicators were done due to invalidity issues (Table 3). Furthermore, the discriminant validity test indicates that the cross-loading values of each variable's indicator are greater than 0.70, and the cross-loading value of one latent variable is greater than the cross-loading value of the other latent variables. Hence, it can be concluded that all indicator items within the latent variables are finally valid.

The study also assessed discriminant validity using the Heterotrait-Monotrait (HTMT) ratio. The measurement model is considered valid if the HTMT value is less than 0.90. Based on the results presented in Table 4, all variables satisfy the criteria, confirming discriminant validity.

The measurement model is then used to measure the reliability of the indicators and latent variables of the study by analyzing the values of Cronbach's alpha and composite reliability, as presented in Table 3. Test results on the outer model show that the values of Cronbach's alpha and composite reliability for each latent variable are above 0.70, thus confirming that the data used by the researcher is reliable. In addition, a test for multicollinearity was performed using the Variance Inflation Factor (VIF) scores. As shown in Table 5, no multicollinearity issues were detected, since all VIF values are below the recommended threshold of 10.

Table 6.

Model	Saturated model	Estimated model
SRMR	0.071	0.071
d_ULS	2.065	2.065
d_G	1.045	1.045
Chi-square	2.265.843	2.265.843
NFI	0.795	0.795

The overall model also shows an adjusted R^2 of 0.043, which means that only 4,3% of the SDGs' performance variance is explained by the independent variables. The study also assessed the model's goodness of fit by relying on the SRMR score. According to Table 6, the SRMR value is below 0.1, confirming that the model demonstrates a good fit. Furthermore, the results of the hypothesis test are presented in Table 7.

Table 7. Hypothesis Test Results

Details	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	t-statistics (|O/STDEV|)	p-values	Conclusion
Digitalization on Green Campaign → SDGs Performance	0.201	0.214	0.049	4,102	0.000	Supported
Digitalization on Quality Control → SDGs Performance	0.001	0.019	0.060	0.025	0.980	Not Supported
Digitalization on Supply Chain → SDGs Performance	0.066	0.077	0.046	1,438	0.151	Not Supported

H_1 predicts the positive relationship between the digitalization of green campaigns and SDGs' performance. The results in Table 5 confirm this prediction, which shows p=0.000. Thus, the H_1 is supported.

H_2 proposes that the digitalization of quality control has a positive effect on SDG performance. However, the results represent p=0.980, which means that the hypothesis is not supported. Similarly, the test on H3 also represents the contradictory results with the prediction. The hypothesis predicts the positive effect of digitalization of the supply chain on SDG performance. Yet, the result does not confirm it with p=0.151.

Discussions

The test of the hypothesis shows that H_1 is supported. In other words, it is confirmed that the digitalization of green campaigns has a positive effect on the SDGs performance of MSMEs. This result is consistent with the Resource-Based View (RBV) theory, which states that internal resources can result in competitive advantages for the organization. The knowledge to use digital technology to support and promote a green campaign leads to a higher SDG performance of the MSMEs. This study confirms the previous studies (Afum et al., 2020; Karuppiah et al., 2020), which proved the role of RBV in explaining the positive effect of digitalization in the green campaign on SDG performance. MSMEs practice the digitalized green campaign by promoting eco-friendly products and payments, representing the shop-floor activities that they can engage in without sophisticated planning and expensive resources. Green promotion is the most critical antecedent in green marketing in MSMEs that postitively affect overall firm performance (Oduro & Matarazzo, 2025). This finding shows how MSMEs adapt their operations as a response to the pandemic by joining the online ecosystem, starting from the most possible step (Kahveci et al., 2024; Takeda et al., 2022).

The H_2 is not supported by the statistical results, showing nonconformity to the extant research (Afum et al., 2020; Ageron et al., 2020; Sarkis et al., 2021). This result is also not in line with the notion of RBV theory on the positive effect of digitalization of the supply chain on SDG performance. This finding can be explained by the fact that the level of digitalization in the organization is also related to the organizational culture, which collectively determines the vision and mission toward certain goals (Isensee et al., 2020). Furthermore, the supply chain is also related to the use of technology for horizontal integration between organizations, suppliers, and customers, which requires vertical integration between organizational IT competence and shop floor digitalization (Buer et al., 2021). However, these two conditions are in contrast to the MSMEs, especially in the surveyed subjects. Supply chain resilience plans developed by MSMEs are not necessarily the same as those of large enterprises (Safari et al., 2024). The MSMEs are less resourceful in those two factors due to the small number of personnel in the team, resulting in a flat organization. This type of organization does not need

sophistication in the supply chain, yet it prefers the most efficient way (Safari et al., 2024; Sopha et al., 2021), also in terms of connecting itself with suppliers and customers. It indicates that the number of people and, further, the hierarchy of the organization can potentially affect the level and efficacy of digitalization in the supply chain and its effect on SDG performance.

The finding also does not support the H_3 prediction that digitalization of quality control positively affects SDG performance. The result reflects that the use of technology in conducting quality control does not necessarily determine the level of SDG performance. In the early stages, MSMEs do not use advanced techniques for quality control. It is in line with the fact that a flat organization is more suitable for using lean and simple management of its operation, and is usually characterized by a lack of quality control (Islam, 2020). MSMEs have not implemented the PDCA cycle in quality control since the use and application of its technology-driven mechanisms may require substantial initial financial investments (Menon et al., 2022). In sum, MSMEs cannot achieve an optimal use of digitalization of quality control because of the lack of resources to implement it. This condition underlies no relationship between digitalization in quality control and SDG performance.

CONCLUSIONS, LIMITATIONS, AND SUGGESTIONS

This study aims to examine the effect of digitalization on SDG performance in three areas of operations, i.e., green campaign, supply chain, and quality control. By using 414 data from MSMEs in East Java Province, Indonesia, this study supports the RBV based on finding the positive effect of digitalization of green campaigns on SDG performance. However, this study does not provide support for the effect of digitalization of the supply chain and quality control on SDG performance.

These findings address the gap in the literature by integrating three important factors in MSMEs that contribute to the achievement of the SDGs: digitalization, green practices, and performance. While the role of digitalization in influencing MSME performance has been widely studied, this research highlights that green-oriented activities within MSMEs positively correlate not only with the financial but also the non-financial performance, specifically, SDG-related outcomes.

The positive impact of digitalized green campaigns on SDG performance suggests that such initiatives can provide a competitive advantage, not only for large companies but also for MSMEs, including those at the micro level. Furthermore, this finding indicates a strong alignment between green actions and the SDG performance, which may serve as both a value proposition and a source of strength in delivering enhanced customer value.

These results also suggest that the concept of SDGs and the green movement have been understood and implemented by MSMEs at an optimal level, especially aligned with the Government's strategic plan on MSMEs' digitalization and resilience. Yet, the current implementations of digitalization in support of SDG initiatives remain at an early stage, primarily focused on promotional efforts, such as social media campaigns, rather than on operational areas like supply chain management or quality control. This is largely due to the limited resources within MSMEs, which often operate with flat organizational structures and prioritize simplicity and efficiency. Additionally, the high investment cost associated with digitalization remains a significant challenge for the majority of MSMEs.

This study is subject to several limitations. *First*, the variance explanatory power, proxied by the adjusted R^2 in this study, is relatively low. This fact is possibly due to the drop in some indicators in the variables caused by the invalidity issues. However, the amount of data in this study still provides sufficient assurance of the results. *Second*, the respondents of this study consist mostly of MSMEs in the early stage; thus, the potential effect of experience length and sophistication level in implementing digitalization cannot be identified. Future research can focus specifically on certain groups of MSMEs to address this area.

Third, this study neglects the MSMEs' long-term direction and agenda regarding the SDG and digitalization, as well as their motivation to be mindful of those concepts in their operation, which future studies may acknowledge more in this area. *Fourth*, as this study has provided the preliminary

findings on how MSMEs participate in the SDGs measures through their digitalized green campaigns, future studies may consider exploring this practice in depth through a case study and interviews. For instance, exploring the specific mechanism of the green campaign and how MSMEs, in turn, correlate their business to SDGs would be insightful for the literature. *Last*, the majority of the respondents in this study are female, implying that this result may be subject to female-specific characteristics, such as the degree of interest in green activities. However, since this is not the focus of the current study, future studies may consider the role of gender in MSMEs' green efforts.

CONFLICTS OF INTEREST

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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