ENHANCING MSMEs' SUSTAINABILITY THROUGH DIGITAL ADOPTION AND GREEN ORIENTATION: THE ROLE OF GREEN PRODUCT INNOVATION

A THESIS

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INTERNATIONAL UNDERGRADUATE PROGRAM IN MANAGEMENT
FACULTY OF BUSINESS AND ECONOMICS
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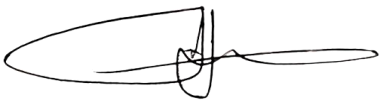
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DECLARATION OF AUTHENTICITY

Herein I declare the originality of this thesis; I have not presented anyone else's work to obtain my university degree, nor have I presented anyone else's words, ideas, or expressions without acknowledgment. All quotations are cited and listed in the bibliography of the thesis. If in the future this statement is proven to be false, I am willing to accept any sanctions complying with the determined regulation or its consequences.

Yogyakarta, 27 October 2025



(Nailin Na'imah)

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ENHANCING MSMEs' SUSTAINABILITY THROUGH DIGITAL ADOPTION AND GREEN ORIENTATION: THE ROLE OF GREEN PRODUCT INNOVATION

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ABSTRACT

Micro, Small, and Medium Enterprises (MSMEs) face difficulties in combining sustainable practices with digital technology to maintain competitiveness amid increasing environmental demands and digital changes. This study aims to analyse the impact of digital technology adoption, green dynamic capability, and green market orientation on the sustainable performance of MSMEs, with green product innovation as a mediating factor. This research uses a quantitative methodology, collecting primary data from 105 MSME owners or managers in Yogyakarta through an online questionnaire, which was then analysed using Partial Least Squares-Structural Equation Modelling (PLS-SEM). The findings show that the use of digital technology, green dynamic capabilities, and green market orientation significantly increase green product innovation and sustainable performance, with green dynamic capabilities having the most significant impact. Green product innovation fully mediates the relationship between green market orientation and sustainable performance, highlighting the importance of MSMEs' ability to develop environmentally friendly products to improve sustainable performance. These findings theoretically enrich sustainable business theory and provide practical implications for MSMEs to accelerate digital adoption, develop green capabilities, and promote environmentally friendly product innovation to improve sustainable competitiveness.

Keywords: *Digital Technology Adoption, Green Dynamic Capability, Green Market Orientation, Green Product Innovation, Sustainable Performance, MSME*

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ABSTRAK

Usaha Mikro, Kecil, dan Menengah (UMKM) menghadapi kesulitan dalam menggabungkan praktik berkelanjutan dengan teknologi digital untuk mempertahankan daya saing di tengah tuntutan lingkungan yang semakin meningkat dan perubahan digital. Penelitian ini bertujuan untuk menganalisis dampak adopsi teknologi digital, kapabilitas dinamis hijau, dan orientasi pasar hijau terhadap kinerja berkelanjutan UMKM, dengan inovasi produk hijau sebagai faktor mediasi. Penelitian ini menggunakan metodologi kuantitatif, mengumpulkan data primer dari 105 pemilik atau manajer UMKM di Yogyakarta melalui kuesioner online, yang kemudian dianalisis menggunakan Partial Least Squares-Structural Equation Modeling (PLS-SEM). Temuan menunjukkan bahwa penggunaan teknologi digital, kapabilitas dinamis hijau, dan orientasi pasar hijau secara signifikan meningkatkan inovasi produk hijau dan kinerja berkelanjutan. Kapabilitas dinamis hijau memiliki dampak paling signifikan. Inovasi produk hijau sepenuhnya memediasi hubungan antara orientasi pasar hijau dan kinerja berkelanjutan, menyoroti pentingnya kemampuan UMKM untuk mengembangkan produk ramah lingkungan guna meningkatkan kinerja berkelanjutan. Temuan ini secara teoritis memperkaya teori bisnis berkelanjutan dan memberikan implikasi praktis bagi UMKM untuk mempercepat adopsi digital, mengembangkan kemampuan hijau, dan mempromosikan inovasi produk ramah lingkungan guna meningkatkan daya saing berkelanjutan.

Keywords: *Digital Technology Adoption, Green Dynamic Capability, Green Market Orientation, Green Product Innovation, Sustainable Performance, MSME*

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CHAPTER I

INTRODUCTION

1.1 Background

The contemporary digital era has triggered fundamental transformations in business operations worldwide, particularly in integrating sustainable practices into business models across various sectors (Le et al., 2024). Global environmental challenges, including climate change, resource scarcity, and pollution, have reinforced the urgency for businesses to adopt sustainable practices that balance economic growth with environmental protection and social responsibility (Alahdal et al., 2025). The paradigm shift towards sustainability is becoming increasingly critical as stakeholders, including consumers, investors, and governments, demand greater corporate accountability for environmental and social impacts (Polo et al., 2025). This phenomenon is further reinforced by the Indonesian government's commitment to achieve net zero emissions by 2060 or earlier, as well as its efforts to realise the 2030 Sustainable Development Goals (SDGs) (Lou et al., 2024). This shift is not only occurring at the level of large industries, but is also being adopted by the MSME sector. In line with this development, digital transformation has become a guideline for businesses, especially MSMEs, to remain competitive and sustainable (Martínez-Peláez et al., 2024).

In Indonesia, MSMEs have a significant impact on the economy, contributing 61% of the Gross Domestic Product (GDP) and employing 97% of the workforce (Munandar et al., 2025). In the Special Region of Yogyakarta

(DIY), MSMEs are the backbone of the regional economy, featuring a variety of businesses managed by the community, and experiencing positive growth every year. Data from the DIY Regional Development, Research, and Innovation Agency show that in 2025, around 347,391 MSMEs will be spread across various regencies and cities in DIY, including Bantul, Gunungkidul, Kulon Progo, Sleman, Yogyakarta City, as well as non-DIY residents that operate businesses in DIY. The data can be seen in Table 1.1 below:

Table 1.1
MSMEs by Region

MSMEs by Region	2021	2022	2023	2024	2025
Bantul	90.611	86.986	91.775	93.846	94.247
Gunungkidul	55.429	53.960	57.761	58.806	58.964
Kulonprogo	36.954	36.141	37.398	38.193	38.342
Sleman	84.756	113.962	86.129	88.999	89.393
Yogyakarta City	39.021	32.793	39.807	42.191	42.500
Non-DIY residents doing business in DIY	30.289	19.082	29.716	23.945	23.945
Total per year	**337.060**	**342.924**	**342.586**	**345.980**	**347.391**

Source: bapperida.jogja.prov.go.id

In Yogyakarta, the trend towards environmentally friendly businesses in the MSME sector continues to grow, but the level of adoption of sustainable practices is still moderate and not yet fully integrated into daily operational processes (Lesmana et al., 2025). However, this sector faces significant challenges in achieving sustainable performance, especially in the context of

climate change and digital disruption, which require more innovative adaptation of business strategies (Martínez-Peláez et al., 2024). The main obstacles include limited knowledge of sustainability strategies, minimal access to green technology, and limited capital for investment in green practices (Lesmana et al., 2025). Furthermore, although green innovation has been proven to have a positive impact on business performance, the level of awareness and understanding among MSME actors regarding the importance of green innovation is still low (Akbarrama, Sumarlin, & Nuvriasari, 2024). It is important to examine how digital technology adoption, the development of dynamic green capabilities, and encouraging green innovation can be strategic approaches to improving the sustainability of MSMEs in Yogyakarta.

This issue has complex implications. The inability of MSMEs to adopt sustainable practices not only risks causing a loss of competitiveness, especially in a global market that increasingly prioritises environmentally friendly products, but also has the potential to exacerbate negative impacts on the environment (Zhang, 2024). Conversely, MSMEs that implement sustainable principles can reap various strategic benefits, such as enhanced brand image, consumer loyalty, operational efficiency, and access to premium markets (Martínez-Peláez et al., 2023). However, without relevant innovation, green strategies will remain mere slogans with no real impact on sustainability. Research conducted by Wang and Zhang (2025) shows that the adoption of digital technology and dynamic capabilities can improve the green innovation and sustainable performance of companies. In addition, flexibility,

adaptability, and proximity to consumers are advantages that can be optimised to effectively implement green business practices (Li et al., 2024).

In this context, sustainable performance has become a key indicator in current MSME business practices. This study uses the Triple Bottom Line (TBL) framework developed by Elkington (1997), which emphasises that company performance should be evaluated based on three dimensions: economic (profit), social (impact on people), and planetary (environmental impact). MSME performance that encompasses these three dimensions reflects their ability to create long-term value while remaining mindful of their social and environmental responsibilities (Ndubisi et al., 2021). Several factors, such as digital technology adoption, green dynamic capability, green market orientation, and green product innovation, greatly influence this improvement in sustainable performance. The adoption of digital technology through the use of e-commerce, social media, and other digital systems has been proven to increase operational efficiency and business innovation in MSMEs (Sudirman et al., 2025). Green dynamic capability is a company's high-level ability to achieve sustainable and green development in an ever-changing market by integrating existing resources in a sustainable manner, which ultimately leads to the greening of products and processes (Weber et al., 2025). In addition, green market orientation plays a role in supporting the ability of MSMEs to respond to consumer demand that is aware of environmental issues and integrate it into their business strategies (Tjahjadi et al., 2020). Green product innovation, which involves developing environmentally friendly products

through the selection of sustainable raw materials, more efficient production processes, and product designs that minimise negative impacts on the environment, is also an important factor in the sustainability performance of MSMEs (Sulaiman, 2025).

Despite progress in research on sustainability in the MSME sector, there is still a significant knowledge gap regarding the integrative influence between digital technology adoption, green dynamic capabilities, green market orientation, and green product innovation, especially in the context of MSMEs in Yogyakarta. Li et al. (2022) examined the impact of digital technology adoption on improving sustainable development performance in emerging strategic industries, but did not link this to green dynamic capabilities and green product innovation simultaneously within the SME framework. Borah et al. (2025) examined green dynamic capabilities, such as green operational capabilities, green transactions, and green technology development, in relation to increasing green product innovation for sustainable development, but did not discuss the importance of digital technology adoption and green market orientation as essential prerequisites. Furthermore, Sulaiman (2025) shows that green product innovation mediates the relationship between green market orientation and sustainable performance in SMEs; however, this study lacks an analysis of the simultaneous role of green dynamic capabilities and digital technology adoption.

As market pressures and consumer awareness increase, especially among younger generations who care about sustainability, research examining

the combined impact of digital technology adoption, green dynamic capabilities, green market orientation, and green product innovation on the sustainable performance of MSMEs in Yogyakarta is highly relevant. This study aims to fill the empirical gap and provide theoretical contributions by proposing an integrative model that can serve as a reference for the development of sustainable SMEs. The findings of this study have significant implications for policymakers and business stakeholders who aim to improve the competitiveness of SMEs sustainably, especially in the context of ongoing digital technology development and market demand. This study is entitled "**Enhancing MSMEs' Sustainability Through Digital Adoption and Green Orientation: The Role of Green Product Innovation**".

1.2 Problem Formulation

Based on the context discussed above, there is a paradoxical situation in which consumer demand for sustainable products continues to increase, but MSMEs in Yogyakarta have not yet widely adopted sustainable practices. Although people are becoming more environmentally conscious and preferring environmentally friendly goods, many MSMEs find it challenging to adopt green innovations and achieve optimal sustainability. This situation raises important questions about methods that can facilitate the transition of traditional MSMEs to competitive and profitable sustainable business models. To address these questions, the following problems are formulated

1. Does digital technology adoption influence green product innovation in MSMEs?

2. Does green dynamic capability influence green product innovation in MSMEs?
3. Does green market orientation influence green product innovation in MSMEs?
4. Does digital technology adoption influence sustainable performance in MSMEs?
5. Does green dynamic capability influence sustainable performance in MSMEs?
6. Does green market orientation influence sustainable performance in MSMEs?
7. Does green product innovation influence sustainable performance in MSMEs?
8. Does green product innovation act as a mediator in the influence of green market orientation on sustainable performance in MSMEs?

1.3 Research Objectives

This research examines the influence and interaction between green dynamic capabilities, green market orientation, digital technology adoption, and green product innovation on sustainable performance, particularly in the context of MSMEs facing current business challenges. The purpose of this study is to gain a comprehensive understanding of the factors that contribute to the success of MSMEs in implementing sustainable and competitive business practices.

1. To analyze the influence of digital technology adoption on green product innovation in MSMEs.
2. To analyze the influence of green dynamic capability on green product innovation in MSMEs.
3. To analyze the influence of green market orientation on green product innovation in MSMEs.
4. To analyze the influence of digital technology adoption on sustainable performance in MSMEs.
5. To analyze the influence of green dynamic capability on sustainable performance in MSMEs.
6. To analyze the influence of green market orientation on sustainable performance in MSMEs.
7. To analyze the influence of green product innovation on sustainable performance in MSMEs.
8. To analyze the mediating role of green product innovation on the influence of green market orientation on sustainable performance in MSMEs.

1.4 Research Benefits

1. Theoretical benefits

   This research aims to improve operational management and sustainable business theory, particularly by examining the impact of digital technology adoption, green dynamic capabilities, green market orientation, and green product innovation on sustainable performance in

MSMEs. The findings of this study are expected to serve as a reference for future researchers planning to conduct research in this field.

2. Practical benefits

   a. For researchers

      This research provides an empirical understanding of the implementation of digital and green strategies in improving innovation capability and business sustainability in the MSME sector, which contributes significantly to environmental impact.

   b. For business practitioners

      This research provides guidance and an evaluation basis for implementing digital and green strategies to improve the sustainable performance and business competitiveness of MSMES. The findings can help MSME owners in Yogyakarta develop effective strategies for implementing digital technology and green innovation.

   c. For future researchers

      This research provides a reference and theoretical basis for further research on digital technology adoption, green dynamic capabilities, green market orientation, green product innovation, and sustainable performance in the MSME sector in Indonesia.

CHAPTER II

LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Digital Technology Adoption

Digital technology adoption refers to how organisations or individuals integrate and implement digital technologies into business operations to improve efficiency, productivity, and competitiveness (Dimoso & Utonga, 2024). Chirumalla et al. (2025) define digital technology adoption as the integration and implementation of digital technology to improve operations, decision-making, and overall organisational efficiency, which is influenced by various determining factors such as adoption costs, top management support, human resources, digital culture, and pressure from trading partners. Furthermore, Sudirman et al. (2025) explain digital technology adoption as the acceptance, use, and utilisation of new technologies by MSMEs to improve operations, products, or services, which is influenced by technological, organisational, and environmental factors.

The Technology-Organisation-Environment (TOE) Framework is a theoretical framework that explains how adopting and implementing technological innovations is influenced by three main contexts: technology, organisation, and environment (Baker, 2011). The technological context includes internal and external technological characteristics relevant to the organisation, such as complexity,

compatibility, and relative technological advantage (Baker, 2011). The organisational context refers to the resources and internal characteristics of the organisation, including its size, organisational readiness, top management support, and organisational culture (Abekah-Nkrumah et al., 2022). The environmental context includes industry structure, government support, competitive pressure, and vendor quality that influence technology adoption decisions (Abekah-Nkrumah et al., 2022).

In the context of MSMEs, digital technology adoption includes using e-commerce platforms, social media for marketing, digital payment systems, and business management applications that facilitate digital transformation (Dimoso & Utonga, 2024). SMEs that comprehensively adopt digital technology, from basic infrastructure to applications in various business functions, can expand their market reach without geographical limitations, reduce operational costs, improve business process efficiency, accelerate data-driven decision making, and increase customer satisfaction through more responsive services (Sudirman et al., 2025).

2.1.2 Green Dynamic Capability

Green dynamic capabilities are a company's comprehensive ability to engage in organisational learning, integrate internal and external resources, and dynamically allocate environmental management resources to cope with environmental protection market changes (Huang & Xiao, 2023). Li et al. (2024) define green dynamic capability as a

company's ability to update and develop green organisational capabilities within its existing knowledge base to respond to dynamic markets. The green dynamic capability concept integrates environmental issues into dynamic capability theory, emphasising the importance of a company's ability to adapt to environmental sustainability demands (Mubeen et al., 2024). The dynamic capability theory developed by Teece et al. (1997) explains a company's ability to deliberately integrate, build, and restructure internal and external competencies to cope with a rapidly changing environment. Sensing refers to a company's ability to recognise and identify opportunities and threats in the external environment, seizing represents a company's ability to capitalise on opportunities through strategic actions and resource mobilisation, and transforming/reconfiguring indicates a company's ability to continuously update and reconfigure its organisational structure, assets, and operational processes to maintain competitive relevance (Bleady & Ali, 2018).

Green dynamic capabilities consist of three main dimensions adapted from the concept of dynamic capabilities: green learning capabilities, green integration capabilities, and green configuration capabilities (Mubeen et al., 2024). Green learning capability emphasises a company's ability to recognise, extract, and share green knowledge. This dimension includes an organisation's ability to continuously learn about environmental practices, environmentally friendly technologies,

and environmentally conscious market needs (Xiao et al., 2023). Green integration capability emphasises a company's ability to absorb and internalise green knowledge into its business processes. This capability involves integrating environmental knowledge from various external and internal sources to create innovative, environmentally friendly solutions (Bari et al., 2022). Green configuration capability emphasises a company's ability to dynamically configure green resources by scanning and predicting the environment to develop environmentally friendly practices. This capability enables companies to allocate resources effectively to support green innovation and sustainable practices (Mubeen et al., 2024).

In the context of MSMEs, GDC reflects an organisation's strategic capacity to identify environmentally friendly opportunities, configure sustainable resources, and optimise organisational structures by considering environmental aspects (Mubeen et al., 2024). This capability enables companies to respond quickly and effectively to stakeholder needs related to environmental issues, thereby increasing efficiency in green innovation practices (Xiao et al., 2023). MSMEs with green dynamic capabilities can integrate external environmental knowledge with internal capabilities to develop sustainable green innovations (Amaranti et al., 2024).

2.1.3 Green Market Orientation

Green market orientation refers to a strategic business approach that emphasises the integration of environmental considerations into marketing practices (Qu et al., 2020). Peris et al. (2020) explain that green market orientation involves aligning business operations with green principles, such as sustainable resource use, energy efficiency, and pollution reduction to meet the needs of environmentally conscious consumers. Green market orientation extends the traditional market orientation concept by integrating environmental considerations as a key strategic focus (Papadas et al., 2017). Market orientation theory emphasises the importance of market orientation as a business strategy focusing on deeply understanding customer needs, monitoring competitor activities, and cross-functional coordination to create superior customer value (Slater & Narver, 1994). In the context of environmental sustainability, market orientation theory has evolved into green market orientation, which integrates environmental aspects into each component of market orientation (Wang, 2020).

Green market orientation consists of several key dimensions that reflect the integration of environmental aspects into market orientation. The first dimension is green customer intelligence, which refers to a company's ability to identify, collect, and analyse information about customer preferences for environmentally friendly products (Wang, 2020). The second dimension is green competitor intelligence, which

includes monitoring and analysing the environmental strategies implemented by competitors to maintain competitiveness (Ngo, 2022). The third dimension is inter-functional coordination, which involves inter-functional coordination within the organisation to implement green marketing strategies effectively. This dimension ensures that environmental information is disseminated throughout the organisation and used in strategic decision-making (Papadas et al., 2017).

In the context of SMEs, Sulaiman (2025) explains that green market orientation serves as a strategic mechanism for detecting and responding to increasingly environmentally conscious market opportunities. SMEs with a strong green market orientation can identify sustainable business opportunities, build relationships with environmentally conscious consumers, and create competitive advantages through environmentally friendly product differentiation (Zhang, 2024). Green market orientation also helps companies align their environmental goals to improve customer satisfaction, financial performance, environmental competitiveness, and brand reputation (Tjahjadi et al., 2020).

2.1.4 Green Product Innovation

Green product innovation refers to developing new products or improving existing products by considering environmental aspects to reduce negative environmental impacts (Zhang et al., 2021). Du and Wang (2022) define green product innovation as advanced product

development involving less hazardous materials, better packaging, and recycled and remanufactured parts. In addition, Liu et al. (2023) define green product innovation as a systematic transformation that integrates sustainability into core business strategies through product development that simultaneously creates economic and environmental value while reducing negative environmental impacts. Green product innovation includes innovation in product design, selection of environmentally friendly raw materials, energy-efficient production processes, and recyclable packaging systems (Du & Wang, 2022).

Environmentally friendly product design includes developing products with recycled materials, minimising the use of hazardous materials, designing with energy efficiency in mind, and ensuring ease of recycling at the end of a product's life cycle to reduce its overall environmental footprint (Badhoutiya et al., 2023). Using sustainable raw materials includes selecting materials from renewable resources, using organic and non-toxic materials that are safe for the environment and consumers, and integrating recycled materials into the production process to reduce the exploitation of natural resources (Badhoutiya et al., 2023). Green processing technology involves adopting production technologies that reduce energy consumption, minimise waste through efficient and lean production processes, use environmentally friendly production processes, and implement manufacturing systems that align with sustainable practices (Badhoutiya et al., 2023). Environmentally

friendly packaging refers to the use of packaging that is naturally degradable or biodegradable, packaging that can be reused or refilled to reduce waste, and the reduction of plastic and excessive packaging materials (Badhoutiya et al., 2023).

In the context of MSMEs, green product innovation is increasingly important to maintain competitiveness and respond to environmentally conscious consumer demand (Sulaiman, 2025). Green product innovation is a strategy for sustainable success that involves environmental requirements in product design and is related to a company's environmental performance (Zhang et al., 2021). SMEs that implement green product innovation can create product differentiation in the market, meet the expectations of increasingly environmentally conscious consumers, and achieve resource efficiency that increases profits (Ta'Amnha et al., 2024).

2.1.5 Sustainable Performance

Sustainable performance is a company's performance in all dimensions and factors driving corporate sustainability (Sapsanguanboon et al., 2025). Sustainable performance represents an organisation's ability to create long-term value by integrating economic, social, and environmental aspects into business strategies and operations (Al-Abbadi & Abu Rumman, 2023). Furthermore, Ndubisi et al. (2021) define sustainable performance as a concept that measures a company's performance not only based on financial aspects but also considers the

social and environmental impacts of business activities, which include three main dimensions, namely economic, social, and environmental, which are interrelated and must be integrated to achieve optimal balance.

Sustainable performance consists of three main dimensions that align with the Triple Bottom Line concept: economic performance, environmental performance, and social performance (Nogueira et al., 2023). Economic performance measures a company's ability to generate financial profits, sales growth, and operational efficiency that support long-term sustainability (Li et al., 2020). Environmental performance measures the impact of business activities on the environment, including resource use, emissions, waste, and environmental conservation efforts (Malesios et al., 2020) Social performance measures the impact of business on society, including employee welfare, contributions to local communities, and ethical business practices (Ndubisi et al., 2021).

In the context of MSMEs, sustainable performance refers to a business's ability to achieve economic growth while minimising negative environmental impacts and positively contributing to society (Ndubisi 2021). Malesios et al. (2020) explain that sustainable performance represents the ability of MSMEs not only to survive but also to thrive in the long term by considering economic, environmental, and social aspects in a balanced manner. SMEs that achieve sustainable performance can meet the needs of current stakeholders without compromising the ability of future generations to meet their needs, while

creating added value through responsible business practices (Moursellas et al., 2023).

2.2 Previous Research

The study by Sulaiman (2025) titled “Green product innovation as a mediator between green market orientation and sustainable performance of SMEs” examines the connections among green market orientation, green product innovation, and sustainable performance within a sample of 324 manufacturing SMEs in Oman. This research employs a partial least squares structural equation modelling (PLS-SEM) approach and demonstrates that green market orientation has a direct impact on the sustainable performance of manufacturing SMEs. This research further validates the important mediating role of green product innovation in the connection between green market orientation and the sustainable performance of SMEs.

A study by Tjahjadi et al. (2020), titled "The role of green innovation between green market orientation and business performance: Its implications for open innovation," investigates the impact of green market orientation on business performance, mediated by green innovation, among 175 owners/managers of manufacturing MSMEs in East Java Province, Indonesia. This research used the partial least squares structural equation modelling (PLS-SEM) methodology, utilising data gathered from both online and offline questionnaires. The findings indicate that green market orientation positively and directly impacts business performance. This study empirically validates sustainability and entrepreneurship theory within Indonesian MSMEs. It

indicates that MSME owners or managers must reconcile economic, environmental, and social considerations in their enterprises, embrace green market orientation, and execute green innovation to enhance business performance.

The research by Borah et al. (2025), titled "Green dynamic capability and green product innovation for sustainable development: role of green operations, green transaction, and green technology development Ccapabilities," examines the impact of three capabilities—green operational, green transaction, and green technology development—on the relationship between green dynamic capabilities and green product innovation within 216 manufacturing firms in China. This research uses a structural equation model (SEM) for data analysis. The findings indicate that a firm's green dynamic capabilities exert a substantial and favourable impact on green product creation. This study reveals that green operational capabilities and green transaction capabilities partially mediate the connection between green dynamic capabilities and green product innovation. In contrast, green technology development capabilities positively moderate the relationship between green operational capabilities and green transaction capabilities concerning green product innovation.

A study by Singh et al. (2022) entitled “Stakeholder pressure, green innovation, and performance in small and medium-sized enterprises: The role of green dynamic capabilities” analyses the direct and indirect relationships between stakeholder pressure, green dynamic capabilities, green innovation,

and performance in a sample of 248 small and medium-sized enterprises (SMEs) operating in the emerging market manufacturing sector. This study uses the partial least squares (PLS) path modelling (PLS-PM) methodology to evaluate hypotheses by using data from various sources. The results show that pressure from stakeholders has a significant impact on green dynamic capabilities, which in turn influence green innovation and ultimately improve company performance. This study also reveals that green dynamic capability acts as a mediator in the relationship between stakeholder pressure and green innovation. In contrast, green innovation, in turn, acts as a mediator in the influence of green dynamic capability on organisational performance.

The study conducted by Kiranantawat and Ahmad (2023), entitled "Conceptualising the relationship between green dynamic capability and the SME sustainability performance: the role of green innovation, organisational creativity and agility," explores the interaction between green dynamic capabilities and the sustainability performance of MSMEs, emphasising the importance of green innovation, organisational creativity, and agility. This study is a conceptual investigation that formulates a theoretical framework based on an in-depth review of existing literature. This study argues that green dynamic capabilities positively influence the sustainability performance of MSMEs through the mediation of green innovation. At the same time, organisational creativity and agility serve as moderating factors in the proposed model. The conceptual framework established provides theoretical insights for

researchers while presenting practical implications for MSME managers in developing green capabilities to achieve sustainability performance.

Research by Li et al. (2023), entitled "Enhancing firms' green innovation and sustainability performance through the mediating role of green product innovation and moderating role of employees' green behavior," investigates the influence of green process innovation, green innovation strategy, and green action innovation on sustainability performance. This study highlights the mediating effect of green product innovation and the moderating effect of employee green behaviour, based on data collected from 411 employees in the manufacturing sector in Pakistan. The investigation uses Structural Equation Modelling (SEM) and Partial Least Squares (PLS) Regression to evaluate the proposed hypotheses. The results show that green process innovation, green innovation strategy, and green action innovation contribute positively to sustainability performance. This study establishes that green product innovation acts as a mediator in the interaction between green process innovation, green innovation strategy, green action innovation, and sustainability performance. In addition, employee green behaviour acts as a moderator in the relationship between green product innovation and sustainability performance.

The research by Bo et al. (2024), titled "Research on the mechanism of green innovation of enterprises empowered by digital technology from the perspective of value co-creation," examines the functional attributes of digital technology, stakeholder value co-creation, and corporate green innovation

across 342 manufacturing firms in developing regions of China. This research employs hierarchical regression and bootstrapping techniques to evaluate the hypothesis. The findings indicate that openness and digital technology competencies positively influence green product innovation and process innovation by fostering shared value among enterprises and stakeholders. This study further substantiates that the autonomous advancement of digital technology positively influences the indirect impact of digital technology capabilities on corporate green innovation via the generation of shared value.

A study by Li et al. (2022), titled "Digital technology adoption and sustainable development performance of strategic emerging industries," examines the influence of digital technology adoption on sustainable development performance across 210 new key sectors in China. This study employs a partial least squares structural equation modelling (PLS-SEM) approach to demonstrate that the adoption of digital technology positively and significantly influences sustainable development performance by enhancing operational efficiency, optimising resource utilisation, and improving environmental transparency. The results indicate that firms with elevated digital adoption levels attain superior sustainability outcomes compared to conventional organisations.

The study by Wang et al. (2025), "The impact of digital technology adoption on the similarity of sustainability reports," examines the influence of digital technology implementation on the completeness and consistency of sustainability reports across 312 European manufacturing and service

companies. The study revealed that increased adoption of digital technologies led to more thorough, standardised, and uniform sustainability disclosures, including content analysis and multiple regression techniques. Organisations utilising advanced digital technologies exhibited superior reporting quality scores and markedly enhanced stakeholder transparency.

The study by Hendriana et al. (2024), titled "Analysis of green product innovation and cleaner production technology on business sustainability and competitive advantage in the beauty industry in West Java," investigated the effects of Green Product Innovation and Cleaner Production Technology on Business Sustainability and Competitive Advantage across 160 beauty companies in West Java. This research employs a quantitative methodology utilising the Structural Equation Modelling-Partial Least Squares (SEM-PLS) technique. The results indicate that Green Product Innovation and Clean Production Technology positively influence Business Sustainability, which subsequently enhances Competitive Advantage considerably. This study underscores the significance of carefully incorporating sustainability measures, highlighting their dual function in fostering environmental accountability and offering a competitive edge.

2.3 Hypothesis Formulation

Research by Bo et al. (2024) investigates the mechanisms underlying corporate green innovation influenced by the integration of digital technology, focusing on the co-creation of value. The findings indicate that the use of digital platforms, such as the Internet of Things (IoT), cloud-based data

management systems, and virtual collaboration tools, enhances knowledge integration among stakeholders, expedites the R&D process, and allows for quicker and more precise green product prototyping. Digitalisation facilitates the generation of shared value in green product innovation, enhancing companies' capacity to develop environmentally sustainable solutions. A study by Liu et al. (2023) examined the impact of digital empowerment on green product innovation within China's manufacturing sector. The adoption of digital technologies enhances the integration and reconfiguration of resources, including real-time production data, predictive analytics, and production line automation, thereby mediating the increase in green innovation capacity. This process allows companies to recognise opportunities to minimise their carbon footprint during the product design phase and implement sustainable materials and production methods more effectively.

The synthesis of these research findings indicates that the adoption of digital technology enhances operational efficiency and serves as a significant catalyst for green product innovation. Digital technologies enable SMEs to utilise data from diverse sources and collaborations for the rapid, responsive, and sustainable design, testing, and implementation of environmentally friendly products. Drawing from empirical evidence presented in these studies, the subsequent hypothesis is proposed:

H1: Digital technology adoption influences green product innovation.

Borah et al. (2025) demonstrate that green dynamic capabilities—specifically green operations, green transactions, and green technology

development—substantially enhance companies' green product innovation, thereby facilitating sustainable development. Enhancing the efficiency of sustainable production processes, optimising green supply chains, and advancing eco-friendly technologies enable companies to manufacture green products that possess greater ecological value, thereby boosting competitiveness and minimising environmental impact. Zhu et al. (2023) investigated how green dynamic capabilities contribute to competitive advantage via the implementation of green technology. The findings indicate that green dynamic capabilities enhance an organisation's capacity to recognise opportunities for green product innovation, particularly when bolstered by advanced green technologies. The interplay between green dynamic capabilities and technological infrastructure enhances the green product innovation cycle, enabling companies to better respond to sustainable market demands. Research by Xiao et al. (2023) examines the significance of strategic orientation in relation to green innovation, mediated by green dynamic capabilities. The findings indicate that organisations possessing robust green dynamic capabilities are more effective in converting green strategic orientation into tangible product innovations. Organisational learning and dynamic resource reconfiguration enhance the creation of green products that align with market demands and achieve faster consumer adoption.

The findings of these studies indicate that green dynamic capabilities enhance operational efficiency and incorporate environmental considerations throughout all phases of product innovation. Green operational capabilities

enhance the use of environmentally friendly raw materials; green transactions foster collaboration with sustainable suppliers; and green technology development promotes research and innovation in eco-friendly technologies. The integration of these three capabilities enables MSMEs to identify green innovation opportunities, expedite development, and create products with significant ecological added value. Based on consistent empirical evidence from the studies conducted, a hypothesis is formulated:

H2: Green dynamic capability influences green product innovation.

Sulaiman (2025) demonstrates that green market orientation, which encompasses the collection of market information regarding environmental concerns, proactive engagement with environmentally aware consumers, and responsiveness to environmental feedback, plays a crucial role in fostering green product innovation. By comprehensively understanding the needs of green consumers, companies can effectively design and adapt environmentally friendly products to align with market expectations and enhance sustainable performance. Tjahjadi et al. (2020) investigated the function of green innovation in linking green market orientation to business performance. The findings indicate that a robust green market orientation promotes the development of environmentally sustainable product innovations, subsequently enhancing competitive advantage and profitability. Engaging extensively with environmentally conscious consumers aids in recognising innovation opportunities, reduces product development duration, and enhances green market positioning. Prakoso and Nugroho (2025) examined micro, small,

and medium enterprises (MSMEs) in the food sector in West Java, revealing that green market orientation—encompassing green market segmentation and the promotion of sustainability values—stimulates heightened investment in green product innovation. Micro, Small, and Medium Enterprises (MSMEs) that engage in the collection of green market intelligence and establish reciprocal communication with environmentally conscious consumers have effectively introduced new products characterised by notable sustainability attributes, including biodegradable packaging and the utilisation of certified local green materials.

This study's empirical findings indicate that green market orientation enhances MSMEs' comprehension of green consumer needs and promotes green product innovation. By utilising market intelligence centred on sustainability, MSMEs can pinpoint environmentally aware consumer segments, develop pertinent green product features, and expedite the green innovation development cycle. Based on consistent empirical evidence from the studies conducted, a hypothesis is formulated:

H3: Green market orientation influences green product innovation.

The study conducted by Li et al. (2022) investigates the integration of digital technologies via the deployment of IoT-driven environmental management systems, big data analytics platforms, and process automation in key industries. The findings indicated that digitisation facilitated real-time tracking of energy usage and emissions, enhanced resource optimisation, and promoted interdepartmental collaboration in operational efficiency efforts.

Consequently, organisations could enhance their economic, environmental, and social performance concurrently. A study by Wang et al. (2025) reveals the influence of digitisation levels on the consistency of sustainability reporting. Organisations that embrace advanced digital technologies are likely to generate more thorough, consistent, and reliable sustainability reports. This enhancement in reporting quality signifies superior environmental, social, and economic governance practices, which ultimately foster enhanced sustainability performance.

The collective results of these studies indicate that the implementation of digital technology enhances operational efficiency and reporting transparency while also enabling the incorporation of sustainability principles throughout all organisational operations. Digital technology allows MSMEs to track environmental performance in real time, pinpoint resource-saving options, and provide sustainability reports that enhance business accountability and reputation. Drawing upon consistent empirical evidence from these diverse research studies, the subsequent hypothesis is posited:

H4: Digital technology adoption influences sustainable performance.

Kiranantawat and Ahmad (2023) examine the relationship between green dynamic capabilities and the sustainability performance of MSMEs, highlighting the roles of green innovation, organisational creativity, and agility. Research indicates that green dynamic capabilities promote the advancement of environmentally sustainable innovations, enhance adaptability, and expedite responses to market pressures and environmental regulations. This synergy

leads to concurrent enhancements in the company's economic, environmental, and social performance. Singh et al. (2022) examine the impact of stakeholder pressure on green innovation and business performance, highlighting the mediating role of green dynamic capabilities. The findings indicate that organisations possessing robust green dynamic capabilities can effectively incorporate stakeholder demands into the innovation process, enhancing the efficacy of sustainability initiatives and overall performance. This capability enhances cross-functional coordination, facilitating a more integrated approach to green strategy implementation. Weber et al. (2025) investigated the function of green dynamic capability in promoting green innovation that aids sustainable development. This capability enhances resource utilisation, minimises waste, and reinforces environmental governance. Organisations exhibiting advanced green dynamic capabilities demonstrate notable enhancements in sustainability metrics, including energy efficiency and adherence to environmental regulations.

The findings of these studies indicate that green dynamic capabilities enhance organisations' adaptive and innovative capacities in developing green products, while also promoting comprehensive advancements in sustainable performance. These capabilities enable MSMEs to address stakeholder pressures, optimise green resources, and adopt sustainability practices that enhance their reputation alongside economic, environmental, and social outcomes. Drawing from the consistent empirical findings across multiple studies, the following hypothesis is proposed:

H5: Green dynamic capability influences the sustainable performance of MSMEs.

Research by Sulaiman (2025) indicates that green market orientation—encompassing the collection of green market information, proactive engagement with environmentally aware consumers, and responsiveness to sustainability feedback—directly enhances the sustainable performance of MSMEs. Organisations that modify their marketing strategies according to green market insights experience enhanced operational efficiency, resource conservation, and an elevated environmental reputation, which favorably influences economic, environmental, and social performance. Tjahjadi et al. (2020) investigated the function of green innovation as a mediator between green market orientation and business performance. The findings indicate that a robust green market orientation fosters the creation of environmentally sustainable product and process innovations, therefore improving the company's competitive edge, profitability, and operational sustainability. Engaging extensively with environmentally conscious clients enhances the recognition of pertinent innovation prospects and expedites the development process.

These findings indicate that green market orientation enhances SMEs' comprehension of green customer requirements and promotes the formulation of strategies and innovations that foster comprehensive sustainable performance. By leveraging market intelligence centred on environmental concerns, SMEs can enhance operational efficiency, optimise resource

utilisation, and bolster their competitive standing and sustainable reputation. Drawing from consistent empirical evidence across multiple studies, the subsequent hypothesis is proposed:

H6: Green market orientation influences the sustainable performance of MSMEs.

Research conducted by Sulaiman (2025) indicates that green product innovation, encompassing the creation of eco-friendly features, the utilisation of sustainable resources, and recyclable designs, markedly enhance the sustainable performance of MSMEs. These solutions mitigate environmental footprints, decrease raw material expenses, and enhance the reputation and consumer trust in MSME eco-friendly products. Li et al. (2023) investigate the mediating influence of environmentally sustainable product innovation and the moderating effect of employee eco-friendly behaviour on company sustainability performance. The findings indicate that environmentally sustainable product innovation directly enhances economic, environmental, and social performance. At the same time, employee engagement in eco-friendly practices amplifies these beneficial outcomes, leading to more innovative and sustainable product solutions. Furthermore, a study conducted by Hendriana et al. (2024) examined the influence of eco-friendly product innovation and sustainable production technologies on business sustainability within the beauty sector. Research indicates that MSMEs incorporating eco-friendly product innovation alongside cleaner production methods achieve enhanced energy efficiency, less waste, and sustainable competitive benefits.

These studies demonstrate that green product innovation enhances product differentiation and economic value while simultaneously increasing resource efficiency and environmental reputation. MSMEs that engage in the advancement of green product innovation will attain superior sustainable performance across economic, environmental, and social dimensions. This hypothesis is formulated based on consistent empirical evidence:

H7: Green product innovation influences the sustainable performance of MSMEs.

Research conducted by Sulaiman (2025) indicates that green product innovation serves a significant mediation function between green market orientation and sustainable performance. A robust eco-conscious market orientation fosters the creation of sustainable product attributes, the utilisation of eco-friendly resources, and recyclable designs, thereby enhancing the economic, environmental, and social performance of enterprises. Moreover, research conducted by Tjahjadi et al. (2020) substantiated that green innovation, encompassing green product innovation, serves as a mediator in the correlation between green market orientation and corporate performance. Engaging proactively with environmentally concerned consumers enables the identification of potential for product innovation, thereby enhancing revenues and establishing a sustainable competitive edge.

These studies demonstrate that green product innovation functions as a conceptual link between green market orientation and sustainable performance, while also enabling the conversion of market insights into tangible

sustainability results. The green product innovation method allows MSMEs to recognise environmental market demands, create eco-friendly product solutions, and attain concurrent enhancements in economic, environmental, and social performance. In light of these empirical findings, the subsequent hypothesis is proposed:

H8: Green product innovation mediates the influence of green market orientation on MSMEs' sustainable performance.

2.4 Research Framework

Based on the theoretical basis, previous research, and hypothesis formulation that have been described, this research framework can be illustrated in Figure 2.1, including the relationship between variables in the context of MSMEs in Yogyakarta.

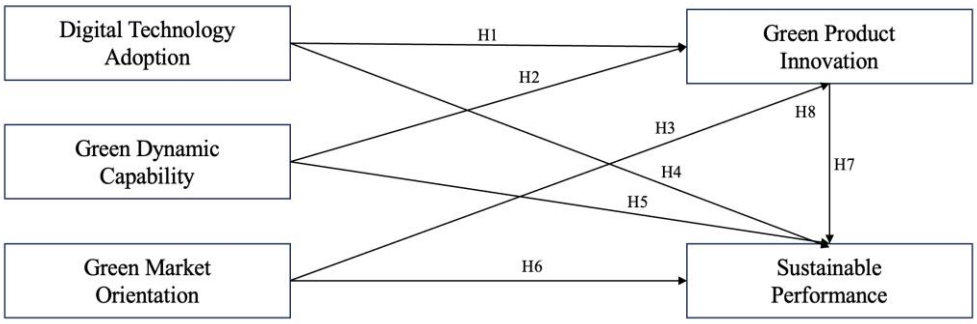


Figure 2.1
Research Framework

H1: Digital technology adoption influences green product innovation

H2: Green dynamic capability influences green product innovation.

H3: Green market orientation influences green product innovation.

H4: Digital technology adoption influences sustainable performance.

H5: Green dynamic capability influences sustainable performance.

H6: Green market orientation influences sustainable performance.

H7: Green product innovation influences sustainable performance.

H8: Green product innovation mediates the influence of green market orientation on sustainable performance.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Approach

This research employs a quantitative methodology. A quantitative approach is a research methodology that employs numerical data to evaluate hypotheses. In the quantitative methodology, the research questions or hypotheses are articulated as dependent or independent variables. Furthermore, the quantitative methodology employs research techniques like surveys and experiments to produce statistical data (Creswell, 2009). This study gathered quantitative data via questionnaires administered to MSMEs in Yogyakarta. The questionnaire assesses the primary variables of interest: digital technology adoption, green dynamic capability, green market orientation, green product innovation, and sustainable performance.

3.2 Research Location

This research is located in Yogyakarta. The selection of this location is based on several strategic considerations. First, Yogyakarta is known as a creative economy center with many MSMEs that contribute significantly to the regional economy. Second, Yogyakarta is a center of education, culture, and high creativity, thus supporting the sustainable development of MSMEs.

3.3 Population and Sample

A population is a collection of individuals, objects, or events from which researchers make conclusions (Sekaran & Bougie, 2016). The

population to be studied in this study is MSMEs in Yogyakarta, totaling 347.391 businesses (Bapperida, 2025). The population includes business owners, managers, or managers of MSMEs operating in Yogyakarta.

Samples in research are part of the population selected for analysis, with respondents as research subjects (Sekaran & Bougie, 2016). By examining the sample, a researcher must draw conclusions that can be generalized to the intended population (Sekaran & Bougie, 2016). This study uses a purposive sampling technique, which is a sampling technique of certain types of people who have relevant information according to the criteria desired by the researcher (Sekaran & Bougie, 2016). To determine a representative sample, this study used the Slovin formula with a margin of error of 10% (0.1). Based on this calculation, the minimum sample size needed is around 105 respondents from a population of 347.391 MSMEs. This sample is expected to represent the population and provide an accurate picture of the influence of digital technology adaptation, green dynamic capability, green market orientation, and green product innovation on the sustainability of MSMEs in Yogyakarta.

3.4 Operational Definition and Variable Measurement

3.4.1 Digital Technology Adoption

Digital technology adoption is operationally defined as the level of integration and utilization of various digital technologies in MSME operational activities, which include technological infrastructure, application software, integrated digital systems, and data analysis capabilities to support business processes ranging from marketing, sales,

customer service, to operational management (Sudirman et al., 2025). His research found that digital technology adoption is not just about using technological devices, but it is a strategic process that requires organizational readiness, including the availability of technological infrastructure, human resource competencies, and the ability to adapt to digital changes. Research by Sanusi (2025) showed that MSMEs with a high level of digital technology adoption can improve operational efficiency, expand market reach, and strengthen competitiveness in the digital era.

This variable is measured through 9 indicators adapted from the research of Sudirman et al. (2025), Liu et al. (2023), and Bo et al. (2024). Each indicator is measured with a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Table 3.1
Digital Technology Adoption

Code	Indicator
DTA1	Accessibility of internet connectivity in the workplace
DTA2	Presence of internet-enabled computers and mobile devices in the workplace
DTA3	Utilisation of digital technologies (e.g., analytics, big data, cloud computing, social media, mobile devices) in commercial transactions
DTA4	Utilisation of digital technologies (e.g., analytics, big data, cloud computing, social media, mobile applications) in internal corporate processes
DTA5	Continuous investment in digital technology efforts (e.g., analytics, big data, cloud computing, social media, mobile) to enhance operations

DTA6	Digital technology enhances precise corporate decision-making.
DTA7	The utilisation of digital technology enhances knowledge management pertaining to company possibilities, products, processes, and services.
DTA8	Enhancement of efficiency and rapidity in information dissemination both internally and externally via digital technology applications
DTA9	Utilisation of digital instruments for the analysis of data across many economic sectors (research and development, production, and services)

3.4.2 Green Dynamic Capability

Green dynamic capability is operationally defined as the dynamic ability of MSMEs to understand, acquire, integrate, and utilize environmentally friendly green technologies to improve resource use efficiency, reduce negative environmental impacts, and promote sustainable innovation throughout the business value chain (Borah et al., 2025). According to Borah et al. (2025), green dynamic capability consists of two main components: traditional green technology capabilities, which involve understanding, procuring, transforming, and utilizing green technology, and green digital technology capabilities, which involve using digital technology to support sustainable business practices and green innovation development. Research by Borah et al. (2025) shows that MSMEs with strong green dynamic capability can leverage digital technology to enhance sustainable innovation and improve environmental performance.

This variable is measured through 10 indicators adapted from the research of Borah et al. (2025). Each indicator is measured on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Table 3.2
Green Dynamic Capability

Code	Indicator
GDC1	Companies often assess market demand for green technology to identify new development opportunities.
GDC2	Companies routinely evaluate the market and analyse the impact of green technology development on consumers.
GDC3	Companies routinely assess environmentally friendly production practices to ensure they meet customer requirements.
GDC4	Companies have protocols for developing new environmental knowledge. Companies can absorb and apply the green knowledge they acquire.
GDC5	Companies can absorb and apply the green knowledge they acquire.
GDC6	Companies are able to integrate the green knowledge they acquire into practical construction processes.
GDC7	Companies can strategically place employees with expertise in sustainable production to enhance their professional development.
GDC8	When companies adopt sustainable manufacturing practices, they enable people to utilise their talents fully.
GDC9	Companies effectively allocate resources and implement innovations in green technology.
GDC10	Companies can quickly assess the environment and identify emerging opportunities.

3.4.3 Green Market Orientation

Green market orientation is operationally defined as the strategic focus of MSMEs in identifying, analyzing, and responding to market needs for environmentally friendly products and services, as well as the ability to integrate environmental sustainability values in all marketing strategies and business operations (Sulaiman, 2025). According to Tjahjadi et al. (2020), Green market orientation encompasses a company's ability to proactively adapt to environmentally conscious consumers' preferences, build long-term commitments with environmentally concerned stakeholders, and create a competitive advantage through sustainable product and service differentiation. This concept refers to mechanisms that help manage market-oriented activities by minimising environmental negative impacts.

This variable is measured through 10 indicators adapted from the research of Sulaiman (2025) and Papadas et al. (2017). Each indicator is measured on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Table 3.3
Green Market Orientation

Code	Indicator
GMO1	Customer satisfaction drives our company to conduct environmentally friendly business.
GMO2	We are always committed to serving customers who care about environmentally friendly products.
GMO3	The company provides information regarding eco-friendly products and services to both staff and customers.

GMO4	The competitive edge of our company is defined by our comprehension of the requirements of environmentally conscious customers.
GMO5	We consistently assess client satisfaction with the characteristics of eco-friendly products and services.
GMO6	The company maintains a customer service department that functions consistently.
GMO7	We invest more in eco-friendly products and services than our competitors.
GMO8	The company exists to offer environmentally conscious customers.
GMO9	The information we offer facilitates clients' evaluation of the quality of eco-friendly products and services.
GMO10	Customer satisfaction metrics are consistently disseminated to all workers.

3.4.4 Green Product Innovation

Green product innovation is defined as developing new products or product modifications that aim to reduce negative impacts on the environment throughout the product life cycle, from selecting environmentally friendly raw materials and efficient production processes to packaging from sustainable recycling systems (Tjahjadi et al., 2020). Based on Sulaiman's (2025) research, green product innovation involves using organic and sustainable materials, waste reduction, the application of more energy-efficient production technologies, developing recyclable designs, and environmentally friendly packaging innovations. This concept refers to the development

of value-added products that meet consumer needs while supporting environmental conservation.

This variable is measured using nine (9) indicators adapted from the research of Sulaiman (2025) and Tjahjadi et al. (2020). Each indicator is measured on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Table 3.4
Green Product Innovation

Code	Indicator
GPI1	Our company uses environmentally friendly raw materials in product development.
GPI2	We use energy-efficient raw materials in the product development process.
GPI3	We enhance the utilisation of raw materials in the production process to minimise waste.
GPI4	We innovate to minimise raw material consumption while maintaining product quality.
GPI5	Our goods are engineered for reusability, recyclability, and natural biodegradability.
GPI6	We efficiently mitigate detrimental pollutants and waste during the manufacturing process.
GPI7	We efficiently reclaim waste and emissions throughout the production process.
GPI8	We effectively reduce water, electricity, and fuel consumption in the production process.
GPI9	We develop and design environmentally friendly packaging, for example by using recyclable materials.

3.4.5 Sustainable Performance

Sustainable performance is defined as the ability of MSMEs to achieve long-term business goals by integrating the three components of sustainability—economic, social, and environmental—into all of their activities. 2025. This method is related to the Triple Bottom Line (TBL) concept, which emphasises that a company's performance must be evaluated based on three pillars: social justice, environmental management, and economic feasibility. In the context of MSMEs, sustainable performance includes efforts to harmonise profitable economic growth, social responsibility towards employees and the community, and environmental conservation through environmentally friendly production methods (Tjahjadi et al., 2020). Research by Hendriana et al. (2024) shows that MSMEs that adopt sustainable practices can increase competitiveness, reduce operational risks, and build a positive reputation among environmentally conscious consumers.

This variable is measured using 11 indicators adapted from Sulaiman's research (2025) with additional supporting references from Tjahjadi et al. Each indicator is measured on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Table 3.5
Sustainable Performance

Code	Indicator
SP1	Our company pays serious attention to the welfare of our workforce, such as providing fair wages and creating a healthy work environment.
SP2	Our company actively contributes to the development of the surrounding community.
SP3	We develop long-term cooperation connections with market partners.
SP4	Our products and services give economic benefits to the larger community.
SP5	Our company operates within a business network that supports the achievement of sustainable economic goals.
SP6	Our business can be considered profitable based on annual turnover.
SP7	We are able to compete in attracting and retaining customers.
SP8	Our business has a competitive market share.
SP9	The products and services we offer do not harm the environment.
SP10	We implement responsible policies in the use of materials and energy.
SP11	In our operations, we strive to use environmentally friendly technologies as much as possible.

3.5 Types and Techniques of Data Collection

This research gathers information utilising primary data types. Primary data refers to original data collected directly by researchers concerning the variables pertinent to the research objectives (Sekaran & Bougie, 2016). The process entails gathering information pertinent to the variables being examined

for a defined objective. Researchers will disseminate questionnaires online via social media platforms frequently utilised by MSME participants, including Instagram, WhatsApp, and TikTok. The questionnaire designed for respondents includes multiple inquiries related to the relevant variables.

In this research, variables are measured using a 5-point Likert scale. This Likert scale was chosen because it can measure the extent to which respondents agree or disagree with specific questions, from a scale of 1 (strongly disagree) to 5 (strongly agree), with a neutral option in the middle (value 3). Thus, this scale allows researchers to calculate mean values and standard deviations and apply more sophisticated statistical techniques to analyze respondents' responses (Sekaran & Bougie, 2016). This study used an online questionnaire with the Google Form platform to collect respondent data.

3.6 Data Analysis Technique

3.6.1 Descriptive Analysis

Descriptive statistics include values such as frequency, mean, and standard deviation that provide a descriptive picture of a data set (Sekaran & Bougie, 2016). This study uses descriptive analysis to present descriptive statistics of the data obtained and describe the respondents' profiles. The respondents' profile data were analysed descriptively, including business type, length of business, number of employees, and business revenue run by the respondents.

3.6.2 Inferential Analysis

Inferential statistics are statistical methods that support the analysis of relationships between variables and make it possible to conclude from research results (Sekaran & Bougie, 2016). In this study, the inferential analysis method is partial least squares-structured equation modeling (PLS-SEM). The PLS-SEM method is an inferential analysis technique suitable for testing complex theoretical models with data that are not normally distributed or have incomplete data. PLS-SEM has several advantages over conventional analysis methods and is suitable for various types of research, including this study.

The PLS-SEM method consists of two main components, namely the measurement model (outer model) and the structural model (inner model), which analyzes the relationship between constructs (Hair et al., 2022). The measurement model links constructs or variables to their indicators (Hair et al., 2022). After the measurement quality is confirmed through evaluation, the analysis proceeds to the next stage to test the hypotheses and discuss the relationship between variables (Hair et al., 2022).

3.6.2.1 Measurement Model Analysis

In this study, the evaluation of the measurement model (outer model) was carried out using a reflective model assessment. In this evaluation, the reflective model assessment

includes several aspects, including convergent validity, discriminant validity, and a reliability test.

1. Convergent Validity

Convergent validity is a measure that indicates the extent to which item variation can be explained and whether indicators of a construct have a positive relationship with the construct (Hair et al., 2022). This evaluation is done through communalities, with an assessment based on the Average Variance Extracted (AVE) of all items related to a particular construct. The level of reliability that is considered satisfactory is indicated by loadings > 0.70, which means that the construct explains more than 50% of the variation in the indicator.

Removal of indicators from the scale can be considered if the indicator loadings are between 0.40 and 0.70, especially if the removal can increase the composite reliability beyond the recommended threshold (Hair et al., 2022). Removal of these indicators may also consider content validity, but indicators with very low loading values, around 0.40 or less, should be removed from reflective scales. The outer loadings value is considered high if the component or indicator correlates is more than 0.70 with the measured construct. Hair et al. (2022) state that the accepted

AVE value is 0.50.

2. Discriminant Validity

Researchers use discriminant validity to ensure that reflective indicators accurately reflect their constructs, with the principle that each indicator should have a strong relationship with the measured construct (Hair et al., 2022). It is important to ensure no high correlation between measurements of different constructs. In the SmartPLS application, the discriminant validity test is carried out by looking at the cross-loading values, which show the correlation between indicators or other constructs in the model.

Based on this criterion, in evaluating the validity of an indicator on a construct, the loading value of the indicator on the construct must be higher than its correlation with other constructs in the model. This criterion ensures that the indicator has a stronger relationship to the intended construct than to alternative constructs (Hair et al., 2022). A construct model has better discriminant validity if each construct's AVE square root value is greater than the correlation between the construct and other constructs in the model.

3. Reliability Test

Reliability is how the results of measuring the same

object can produce consistent data. In this study, variable reliability was measured using Cronbach's alpha. Cronbach's alpha is a method used to measure the lower limit of the reliability level of a construct (Hair et al., 2022).

Cronbach's alpha measures internal consistency with a conservative approach. A Cronbach's alpha value above 0.70 is considered adequate, indicating that the questionnaire's items are reliable and the measurement results are said to be reliable. Conversely, if the Cronbach's alpha value is below 0.70, the items in the questionnaire are considered less reliable or unreliable (Hair et al., 2022).

3.6.2.2 Structural Model Evaluation (Inner Model)

Structural model evaluation involves assessing the collinearity between constructs and the model's predictive ability as an initial step in the evaluation process (Hair et al., 2022). In this analysis, the predictive ability of the model is assessed using five indicators, namely Collinearity VIF, coefficient of determination (R-square), hypothesis testing through the bootstrapping method, path coefficient, and predictive relevance (Q-square) (Sarstedt et al., 2021).

1. Collinearity VIF

In checking for collinearity, this study uses the VIF measure in the formative measurement model (Hair et al.,

2022). This requires researchers to review each predictor construct separately in each part of the structural model. To ensure that collinearity does not affect the estimation results of the structural model, the VIF value must be below 5, ideally less than 5 (Hair et al., 2022).

2. Uji Coefficient of Determination (R2)

During assessing a model with PLS, the initial step involves examining the R-Square value for each independent latent variable. This aims to assess the extent of influence that specific latent variables exert on other latent variables, as well as the significance of this influence. For instance, R-squared values of 0.67, 0.33, and 0.19 reflect varying strengths of the models, categorised as strong, medium, and weak, respectively (Hair et al., 2022). The R-squared values reflect the degree to which the model accounts for variation in the constructs.

3. Hypothesis Testing

The hypothesis testing procedure in this study was conducted utilising the bootstrapping method and path coefficient analysis.

a. Resampling Bootstrapping

This study employs a bootstrapping procedure for hypothesis testing, generating a t-statistic value that is

subsequently compared with the t-table value to evaluate the hypothesis. When the confidence level of the study is set at 95%, the permissible margin of error is (-5%) or 0.05, corresponding to a t-table value of 1.96. According to the guidelines established by Hair et al. (2022), the alternative hypothesis (Ha) will be rejected and the null hypothesis (Ho) will be accepted if the t-statistic value is less than the t-table (t-statistic < 1.96). If the t-statistic value is equal to or greater than the t-table value (1.96), then Ha will be accepted and Ho will be rejected.

b. Path Coefficient

The path coefficient test evaluates the strength of the relationship between constructs, with a coefficient value ranging from -1 to 1. A coefficient value nearing 1 signifies a robust positive relationship. On the other hand, if the coefficient value deviates from 1, the connection between these constructs becomes weaker or potentially detrimental (Hair et al., 2022).

c. Predictive Relevance (Q2)

In addition to the evaluation of the model using R-Square, the assessment of the PLS model involves measuring the predictive relevance of Q-Square constructs. Q2 serves as a crucial metric in PLS

prediction, allowing for the assessment of the model's predictive capabilities. This metric acts as a basic reference point for PLS-SEM outcomes. If the Q2 value exceeds zero, the PLS-SEM estimate is deemed superior to the naive benchmark in terms of predictive capability (Hair et al., 2022). A Q2 value greater than zero signifies that the model demonstrates superior predictive capability when compared to the naive benchmark (Hair et al., 2022). This study assessed predictive relevance through cross-validated redundancy (Q2), utilising the blindfolding procedure in SmartPLS version 4.1.1.4 to derive the Q2 value.

CHAPTER IV

DATA ANALYSIS AND DISCUSSIONS

4.1 Analysis Descriptive

4.1.1 Respondent Profiles Based on Business Type

Respondent profiles were analysed based on their type of business, which was categorised into four different groups: fashion and textiles, food and beverages, furniture, and manufacturing or small industry. Data from the questionnaire showed that most respondents, namely 49 people (46.7%), operated in the fashion and textile sector. The next group consisted of respondents engaged in the food and beverage sector, with a total of 38 participants, representing 36.2% of respondents. The next group consisted of respondents engaged in manufacturing or small industry, with a total of 11 individuals (10.5%). This was followed by respondents in the furniture sector, consisting of 7 individuals (6.7%). Table 4.1 below shows a complete overview.

Table 4.1
Respondent Profiles Based on Business Type

Business Type	Total	Percentage (%)
Fashion dan Textile	49	46,7%
Food and Beverage	38	36,2%
Furniture	7	6,7%
Manufacturing or Small Industry Business	11	10,5%
Total	**105**	**100%**

Source: Primary Data Processed, 2025

4.1.2 Respondent Profiles Based on Business Age

The next respondent profile was analysed based on business age, which was grouped into four categories, namely less than 1 year, 1-5 years, 5-10 years, and more than 10 years. The questionnaire results revealed that the majority of respondents operated businesses aged between 1-5 years, totaling 31, with a percentage of 29.5%. This was followed by businesses aged 5-10 years, 27 respondents or 25.7%, and those operating for more than 10 years, with 26 respondents or 24.8%. Lastly, businesses that have been established for less than 1 year accounted for 21 respondents or 20%. Table 4.2 below shows the details.

Table 4.2
Respondent Profiles Based on Business Age

Business Age	Total	Percentage (%)
<1 year	21	20%
1-5 years	31	29.5%
5-10 years	27	25.7%
>10 years	26	24.8%
Total	**105**	**100%**

Source: Primary Data Processed, 2025

4.1.3 Respondent Profiles Based on Business Revenue

The next respondent profile analysis was conducted based on business revenue, which was classified into three categories: less than 300 million rupiah, more than 300 million to 2.5 billion rupiah, and more than 2.5 to 50 billion rupiah. Of the 105 respondents whose data were

collected, the results showed that 85 businesses, or 81%, generated a revenue of less than 300 million rupiah per year, 17 businesses, or 16.2%, generated a revenue of more than 300 million rupiah to 2.5 billion rupiah per year, and 3 businesses, or 2.9%, generated a revenue of more than 2.5 billion to 50 billion rupiah. For more detailed information, see Table 4.3 below.

Table 4.3
Respondent Profiles Based on Business Revenue

Annual Business Revenue	Total	Percentage (%)
≤300 Million Rupiah	85	81%
>300 Million to 2,5 Billion Rupiah	17	16.2%
>2,5 Billion to 50 Billion Rupiah	3	2.9%
Total	**105**	**100%**

Source: Primary Data Processed, 2025

4.1.4 Respondent Profiles Based on Number of Employees

The profiles of the next respondents were analysed based on the number of employees owned by MSMEs, which were grouped into four categories, namely 1-5 employees, 5-10 employees, 20-50 employees, and more than 50 employees. The results of the analysis show that 65 respondents, or 61.9%, have 1-5 employees, 30 respondents, or 28.6%, have 5-20 employees, 4 respondents, or 3.8%, have 20-50 employees, and 6 respondents have more than 50 employees, or 5.7%. For more detailed information, see Table 4.4 below.

Table 4.4
Respondent Profiles Based on Number of Employees

Number of Employees	Total	Percentage (%)
1-5 People	65	61.9%
5-20 People	30	28.6%
20-50 People	4	3.8%
>50 People	6	5.7%
Total	**105**	**100%**

Source: Primary Data Processed, 2025

4.2 Descriptive Variable Analysis

4.2.1 Digital Technology Adoption

This section of the questionnaire consisted of nine questions related to the Digital Technology Adoption variable, and the descriptive analysis results show that this variable has an overall mean score of 4.18. Among the indicators, the highest mean scores were recorded for items DTA2 and DTA6, both with an average value of 4.30. This indicates that the business surveyed has effectively adopted and utilized digital technology in various operational areas: marketing, customer service, and decision making, to improve operational efficiency and support business sustainability. Conversely, the lowest indicator was found in question DTA9 with an average value of 4.00. Based on these results, it can be concluded that each item obtained an average value that indicates that all variables are in the “agree” category. Further details can be seen in Table 4.5 below.

Table 4.5
Descriptive Variable Analysis of Digital Technology Adoption

Code	Indicators	Mean
DTA1	Accessibility of internet connectivity in the workplace	4.26
DTA2	Presence of internet-enabled computers and mobile devices in the workplace	4.30
DTA3	Utilisation of digital technologies (e.g., analytics, big data, cloud computing, social media, mobile devices) in commercial transactions	4.14
DTA4	Utilisation of digital technologies (e.g., analytics, big data, cloud computing, social media, mobile applications) in internal corporate processes	4.09
DTA5	Continuous investment in digital technology efforts (e.g., analytics, big data, cloud computing, social media, mobile) to enhance operations	4.21
DTA6	Digital technology enhances precise corporate decision-making.	4.30
DTA7	The utilisation of digital technology enhances knowledge management pertaining to company possibilities, products, processes, and services.	4.25
DTA8	Enhancement of efficiency and rapidity in information dissemination both internally and externally via digital technology applications	4.05
DTA9	Utilisation of digital instruments for the analysis of data across many economic sectors (research and development, production, and services)	4.00
Average		**4.18**

Source: Primary Data Processed, 2025

4.2.2 Green Dynamic Capability

This section of the questionnaire includes 10 questions related to the Green Dynamic Capability variable, with descriptive analysis

revealing an average score of 3.97 for this variable. The analysis indicated that question GDC9 achieved the highest score, with an average value of 4.15. This suggests that the managed business demonstrates a strong ability to recognise environmental opportunities, integrate and apply green knowledge, and effectively allocate resources to promote innovation and sustainability. The lowest metric was recorded in question GDC4, yielding an average value of 3.68. The findings demonstrate that every item reached an average value, indicating that all variables are categorised within the agreement range. Further details can be found in Table 4.6 below.

Table 4.6
Descriptive Variable Analysis of Green Dynamic Capability

Code	Indicators	Mean
GDC1	Companies often assess market demand for green technology to identify new development opportunities.	3.91
GDC2	Companies routinely evaluate the market and analyse the impact of green technology development on consumers.	3.91
GDC3	Companies routinely assess environmentally friendly production practices to ensure they meet customer requirements.	3.86
GDC4	Companies have protocols for developing new environmental knowledge. Companies can absorb and apply the green knowledge they acquire.	3.68
GDC5	Companies can absorb and apply the green knowledge they acquire.	4.01
GDC6	Companies are able to integrate the green knowledge they acquire into practical construction processes.	3.91

GDC7	Companies can strategically place employees with expertise in sustainable production to enhance their professional development.	4.05
GDC8	When companies adopt sustainable manufacturing practices, they enable people to utilise their talents fully.	4.06
GDC9	Companies effectively allocate resources and implement innovations in green technology.	4.15
GDC10	Companies can quickly assess the environment and identify emerging opportunities.	4.12
Average		**3.97**

Source: Primary Data Processed, 2025

4.2.3 Green Market Orientation

This section of the questionnaire consists of 10 questions related to the Green Market Orientation variable, with the descriptive analysis indicating an average score of 4.29 for this variable. This analysis reveals that the highest indicator was identified in question GMO2, which recorded an average value of 4.50. This suggests that the managed business exhibits a market orientation centred on customers and environmentally friendly products, demonstrating a commitment to customer satisfaction, the provision of environmental information, and investment in products and services that promote business sustainability. On the other hand, the question GMO7 yielded the lowest indicator, with an average value of 4.10. The findings suggest that each item achieved an average value, placing all these variables within the “agree” category. Additional information is presented in Table 4.7 below.

Table 4.7
Descriptive Variable Analysis of Green Market Orientation

Code	Indicators	Mean
GMO1	Customer satisfaction drives our company to conduct environmentally friendly business.	4.43
GMO2	We are always committed to serving customers who care about environmentally friendly products.	4.50
GMO3	The company provides information regarding eco-friendly products and services to both staff and customers.	4.33
GMO4	The competitive edge of our company is defined by our comprehension of the requirements of environmentally conscious customers.	4.30
GMO5	We consistently assess client satisfaction with the characteristics of eco-friendly products and services.	4.13
GMO6	The company maintains a customer service department that functions consistently.	4.17
GMO7	We invest more in eco-friendly products and services than our competitors.	4.10
GMO8	The company exists to offer environmentally conscious customers.	4.30
GMO9	The information we offer facilitates clients' evaluation of the quality of eco-friendly products and services.	4.32
GMO10	Customer satisfaction metrics are consistently disseminated to all workers.	4.35
Average		**4.29**

Source: Primary Data Processed, 2025

4.2.4 Green Product Innovation

This segment of the questionnaire includes nine questions related to the Green Product Innovation variable, and the descriptive analysis

findings indicate that the mean for this variable is 4.20. This analysis revealed that the highest indicator was observed in question GPI6, which had an average value of 4.30. This suggests that the managed businesses successfully innovated in creating environmentally friendly products by efficiently utilising raw materials, minimising waste, and designing products and packaging that promote recycling and environmental sustainability. On the other hand, the question GPI5 exhibited the lowest indicator, with an average value of 4.14. The results indicate that each item achieved an average value, demonstrating that all these variables fall within the "agree" category. Additional information is presented in Table 4.8 below.

Table 4.8
Descriptive Variable Analysis of Green Product Innovation

Code	Indicators	Mean
GPI1	Our company uses environmentally friendly raw materials in product development.	4.26
GPI2	We use energy-efficient raw materials in the product development process.	4.20
GPI3	We enhance the utilisation of raw materials in the production process to minimise waste.	4.16
GPI4	We innovate to minimise raw material consumption while maintaining product quality.	4.17
GPI5	Our goods are engineered for reusability, recyclability, and natural biodegradability.	4.14
GPI6	We efficiently mitigate detrimental pollutants and waste during the manufacturing process.	4.30
GPI7	We efficiently reclaim waste and emissions throughout the production process.	4.17

GPI8	We effectively reduce water, electricity, and fuel consumption in the production process.	4.17
GPI9	We develop and design environmentally friendly packaging, for example by using recyclable materials.	4.24
Average		**4.20**

Source: Primary Data Processed, 2025

4.2.5 Sustainable Performance

This segment of the questionnaire includes 11 questions related to the Sustainable Performance variable, and the descriptive analysis outcomes indicate that the mean for this variable is 4.08. This analysis revealed that the highest indicator was in question SP1, which had an average value of 4.23. This suggests that the managed business demonstrates sustainable performance by taking into account the balance among economic, social, and environmental factors. On the other hand, the question SP6 yielded the lowest indicator, with an average value of 3.90. The results indicate that each item achieved an average value, suggesting that all variables fall within the “agree” category. Additional information is presented in Table 4.9 below.

Table 4.9
Descriptive Variable Analysis of Sustainable Performance

Code	Indicators	Mean
SP1	Our company pays serious attention to the welfare of our workforce, such as providing fair wages and creating a healthy work environment.	4.23
SP2	Our company actively contributes to the development of the surrounding community.	4.10

SP3	We develop long-term cooperation connections with market partners.	4.21
SP4	Our products and services give economic benefits to the larger community.	4.10
SP5	Our company operates within a business network that supports the achievement of sustainable economic goals.	4.06
SP6	Our business can be considered profitable based on annual turnover.	3.90
SP7	We are able to compete in attracting and retaining customers.	3.99
SP8	Our business has a competitive market share.	4.05
SP9	The products and services we offer do not harm the environment.	4.11
SP10	We implement responsible policies in the use of materials and energy.	4.13
SP11	In our operations, we strive to use environmentally friendly technologies as much as possible.	3.98
Average		**4.08**

Source: Primary Data Processed, 2025

4.3 Validity Test

4.3.1 Convergent Validity

Convergent validity is employed in evaluations to assess the degree to which item variation can be accounted for and to confirm that construct indicators exhibit a positive correlation with the construct. The assessment of validity relies on the Average Variance Extracted (AVE) and Outer Loadings values. The research results are deemed valid if the Average Variance Extracted (AVE) exceeds 0.5 and the Outer Loadings

are at least 0.7 (Hair et al., 2022). Table 4.10 presents the results of the Outer Loadings.

Table 4.10
Outer Loadings

Code	DTA	GDC	GMO	GPI	SP
DTA1	0.835				
DTA2	0.818				
DTA3	0.816				
DTA4	0.838				
DTA5	0.844				
DTA6	0.856				
DTA7	0.849				
DTA8	0.781				
DTA9	0.787				
GDC1		0.835			
GDC2		0.789			
GDC3		0.816			
GDC4		0.807			
GDC5		0.801			
GDC6		0.818			
GDC7		0.811			
GDC8		0.800			
GDC9		0.799			
GDC10		0.834			
GMO1			0.844		
GMO2			0.862		
GMO3			0.820		
GMO4			0.800		
GMO5			0.779		
GMO6			0.774		

GMO7			0.801		
GMO8			0.812		
GMO9			0.821		
GMO10			0,771		
GPI1				0.852	
GPI2				0.855	
GPI3				0.877	
GPI4				0.858	
GPI5				0.880	
GPI6				0.856	
GPI7				0.810	
GPI8				0.834	
GPI9				0.838	
SP1					0.804
SP2					0.783
SP3					0.810
SP4					0.826
SP5					0.792
SP6					0.804
SP7					0.836
SP8					0.802
SP9					0.770
SP10					0.820
SP11					0.823

Source: Primary Data Processed, 2025

According to Table 4.13, all aspects have satisfied the criteria, achieving scores exceeding 0.7. This analysis indicates that each aspect demonstrates strong factor loading coefficients. Based on these results, additional testing may be pursued.

Furthermore, Average Variance Extracted (AVE) serves as a critical metric for assessing convergent validity. For a variable to be considered consistent, its AVE value must be greater than or at least equal to 0.5. Table 4.11 indicates that the AVE values for variables including green dynamic capabilities, green market orientation, digital technology adoption, green product innovation, and sustainable performance exceed an average of 0.5. Consequently, all variables are considered valid.

Table 4.11
Average Variance Extracted

Variable	AVE
Digital Technology Adoption	0.681
Green Dynamic Capability	0.658
Green Market Orientation	0.654
Green Product Innovation	0.725
Sustainable Performance	0.651

Source: Primary Data Processed, 2025

4.3.2 Discriminant Validity

This study employed Cross-Loading criteria to assess discriminant validity. The criteria pertain to the degree of correlation observed between indicators and other constructs within the model. To ensure the validity of an indicator within a construct, the loading value should exceed its correlation with other constructs in the model. This criterion aims to ensure that the indicator is more relevant to the construct

being measured than to other constructs. A comprehensive explanation is provided in Table 4.12, as outlined below.

Table 4.12
Cross Loadings

Code	DTA	GDC	GMO	GPI	SP
DTA1	**0.835**	0.402	0.418	0.477	0.561
DTA2	**0.818**	0.446	0.333	0.496	0.529
DTA3	**0.816**	0.522	0.430	0.516	0.615
DTA4	**0.838**	0.463	0.352	0.450	0.581
DTA5	**0.844**	0.446	0.405	0.501	0.554
DTA6	**0.856**	0.386	0.358	0.488	0.565
DTA7	**0.849**	0.412	0.416	0.517	0.503
DTA8	**0.781**	0.435	0.410	0.449	0.531
DTA9	**0.787**	0.419	0.323	0.383	0.598
GDC1	0.398	**0.835**	0.339	0.434	0.626
GDC2	0.435	**0.789**	0.363	0.442	0.582
GDC3	0.520	**0.816**	0.366	0.451	0.663
GDC4	0.401	**0.807**	0.306	0.398	0.686
GDC5	0.410	**0.801**	0.320	0.419	0.581
GDC6	0.426	**0.818**	0.254	0.436	0.651
GDC7	0.381	**0.811**	0.259	0.403	0.589
GDC8	0.443	**0.800**	0.299	0.482	0.609
GDC9	0.463	**0.799**	0.367	0.481	0.593
GDC10	0.420	**0.834**	0.400	0.543	0.640
GMO1	0.328	0.340	**0.844**	0.471	0.478
GMO2	0.343	0.322	**0.862**	0.503	0.465
GMO3	0.388	0.427	**0.820**	0.518	0.537
GMO4	0.376	0.349	**0.800**	0.534	0.509
GMO5	0.402	0.313	**0.779**	0.476	0.481
GMO6	0.354	0.285	**0.774**	0.399	0.357

GMO7	0.390	0.321	**0.801**	0.534	0.478
GMO8	0.416	0.303	**0.812**	0.446	0.467
GMO9	0.429	0.287	**0.821**	0.489	0.477
GMO10	0.325	0.304	**0.771**	0.472	0.450
GPI1	0.435	0.420	0.598	**0.852**	0.665
GPI2	0.435	0.459	0.473	**0.855**	0.599
GPI3	0.588	0.458	0.534	**0.877**	0.608
GPI4	0.455	0.460	0.468	**0.858**	0.609
GPI5	0.483	0.519	0.465	**0.880**	0.650
GPI6	0.455	0.490	0.496	**0.856**	0.627
GPI7	0.587	0.481	0.510	**0.810**	0.698
GPI8	0.505	0.463	0.467	**0.834**	0.634
GPI9	0.461	0.497	0.587	**0.838**	0.655
SP1	0.557	0.613	0.414	0.608	**0.804**
SP2	0.523	0.643	0.391	0.556	**0.783**
SP3	0.545	0.694	0.515	0.608	**0.810**
SP4	0.540	0.660	0.497	0.580	**0.826**
SP5	0.522	0.625	0.473	0.585	**0.792**
SP6	0.594	0.583	0.457	0.644	**0.804**
SP7	0.563	0.628	0.498	0.610	**0.836**
SP8	0.573	0.628	0.476	0.668	**0.802**
SP9	0.523	0.548	0.469	0.614	**0.770**
SP10	0.602	0.589	0.510	0.655	**0.820**
SP11	0.471	0.594	0.484	0.532	**0.823**

Source: Primary Data Processed, 2025

According to Table 4.12, all variable items are deemed valid as the construction load values for each structure exceed their correlations with other constructions in the model. Consequently, their indicators or manifest variables have precisely represented the latent variables in this

study. This indicates that the variables employed in this investigation possess sufficient discriminant validity.

4.4 Reliability Test

This study employed Cronbach's alpha for the reliability test, which effectively measures internal consistency and serves as a valid indicator. The Cronbach's alpha value should exceed 0.70. A Cronbach's alpha value greater than 0.70 indicates that the variable demonstrates reliability. The results of the Cronbach's alpha test indicated that all variables exceeded the threshold of 0.70, thereby confirming that each variable in this study satisfies the reliability criteria. Table 4.13 below provides a more comprehensive overview of the results.

Table 4.13
Cronbach's Alpha

Variable	Cronbach's Alpha
Digital Technology Adoption	0.941
Green Dynamic Capability	0.942
Green Market Orientation	0.941
Green Product Innovation	0.952
Sustainable Performance	0.946

Source: Primary Data Processed, 2025

4.5 Structural Model Test (Inner Model)

This research employs structural analysis or internal model methods to uncover relationships among variables or correlations between them. This analysis aims to ascertain the R-Square value linked to the dependent variable,

which is utilised for structural testing. Furthermore, measures are implemented from the beginning to explore the relationships identified in this study.

4.5.1 Collinearity Test

Collinearity testing involved an examination of the Variance Inflation Factor (VIF) value to confirm that collinearity did not have a substantial impact on the estimation of the structural model. The criterion applied was that the VIF value should remain below 5 (<5) to confirm the absence of collinearity issues among the indicators or items within the construct. If the VIF value surpasses 5, it signifies a collinearity issue that requires attention. The analysis conducted in this study indicates that the VIF value for each variable remains under 5. This suggests the absence of collinearity issues within the research model. Table 4.14 presents the findings from the collinearity test.

Table 4.14
Collinearity VIF

	DTA	GDC	GMO	GPI	SP
DTA				1.553	1.698
GDC				1.456	1.603
GMO				1.334	1.626
GPI					2.097

Source: Primary Data Processed, 2025

4.5.2 Coefficient of Determination Test (R-Square)

The coefficient of determination, commonly referred to as R-square, serves as a widely accepted metric for assessing the degree to which independent or exogenous variables impact and clarify dependent

or endogenous variables. This coefficient demonstrates the model's predictive capability by quantifying the quadratic relationship between the estimated values and the actual values of various endogenous variables. Consequently, this coefficient illustrates the possible impact of independent variables on dependent variables collectively. Table 4.15 presents the R-square results for each variable as detailed below.

Table 4.15
R-Square

	R Square	Adjusted R Square
Green Product Innovation	0.523	0.509
Sustainable Performance	0.784	0.776

Source: Primary Data Processed, 2025

4.5.3 Hypothesis Test

This study employs path coefficients to analyse the directionality of relationships in hypothesis testing. The values of these coefficients range from -1 to 1. A variable exhibits a negative relationship when its value falls within the range of 0 to -1, while it demonstrates a positive relationship when its value is between 0 and 1. Furthermore, hypothesis testing was performed utilising SmartPLS4, employing the bootstrapping method. Hair et al. (2022) assert that hypothesis testing is governed by two essential principles: the P-value should be less than 0.05, and the t-statistic must exceed 1.96.

Table 4.16 indicates that all hypotheses put forth in this study receive support. The results of the hypothesis testing indicate that H1,

H2, H3, H4, H5, H6, and H7 exert an influence. Table 4.16 below provides a comprehensive breakdown of the hypothesis testing results.

Table 4.16
The Result of The Path Coefficients Test

	Original Sample (O)	T-Statistics (|O\STDEV)	P-Values	Conclusion
Digital Technology Adoption → Green Product Innovation	0.263	2.261	0.024	H1 Confirmed
Green Dynamic Capability → Green Product Innovation	0.264	2.712	0.007	H2 Confirmed
Green Market Orientation → Green Product Innovation	0.373	3.350	0.001	H3 Confirmed
Digital Technology Adoption → Sustainable Performance	0.211	2.391	0.017	H4 Confirmed
Green Dynamic Capability → Sustainable Performance	0.431	6.889	0.000	H5 Confirmed
Green Market Orientation → Sustainable Performance	0.121	2.238	0.025	H6 Confirmed
Green Product Innovation → Sustainable Performance	0.318	3.950	0.000	H7 Confirmed

Green Market Orientation → Green Product Innovation → Sustainable Performance	0.119	2.462	0.014	H8 Confirmed

Source: Primary Data Processed, 2025

4.5.4 Predictive Relevance (Q Square)

This study employed predictive relevance, or Q-square, to assess the model's effectiveness in forecasting variations in the dependent variable. The measurement was conducted utilising the blindfolding method, resulting in a Q-square value. This method operates under a fundamental principle that a Q-square value greater than 0 indicates that the model possesses strong predictive capabilities. In contrast, a Q-square value less than 0 suggests that the model is lacking in effectiveness. The findings indicate that a Q-square value greater than 0 signifies the model's strong accuracy in elucidating pertinent relationships, with further details available in Table 4.17.

Table 4.17
Q-Square

	Q2(=1-SSE/SSO)
Green Product Innovation	0.474
Sustainable Performance	0.703

Source: Primary Data Processed, 2025

4.6 Discussions

4.6.1 Digital Technology Adoption and Green Product Innovation

The first hypothesis of this study posits that the adoption of digital technology positively influences green product innovation. The analysis results provide evidence for this hypothesis, indicated by a p-value of 0.024, which is below the 0.05 threshold, and a t-statistic of 2.261, which exceeds the minimum threshold of 1.96. The results demonstrate a noteworthy beneficial effect. In conclusion, the adoption of digital technology positively enhances green product innovation.

The results align with earlier studies by Bo et al. (2024), indicating that digital technology positively and significantly impacts corporate green innovation. The research indicates that adopting digital technology, encompassing aspects such as openness and adaptability, significantly propels environmentally sustainable product innovation by facilitating value co-creation with stakeholders. This study highlights how digital technology allows companies to more effectively integrate both internal and external resources, thus enhancing their capacity for green innovation in sustainable product development. Additionally, the study by Liu et al. (2023) corroborates these findings, revealing that digital empowerment plays a significant role in enhancing green product innovation, facilitated by the mediating effects of resource integration and reconfiguration within manufacturing firms in China. This study elucidates how digital technology empowers organisations to integrate

digital capabilities, data analysis skills, and collaborative resources to develop innovative, environmentally sustainable products. These capabilities facilitate the identification of environmental opportunities for companies, enable the utilisation of green knowledge from both internal and external networks, and allow for the reconfiguration of production processes to create more sustainable products.

The findings from this study provide empirical support that the integration of digital technology significantly impacts the innovation of green products. Digital technology allows small and medium-sized enterprises to enhance information transparency, improve resource utilisation, and expedite the development of sustainable products. Digital technologies like the Internet of Things, big data analysis, and digital platforms facilitate real-time monitoring of environmental impacts for MSMEs, enabling the identification of inefficiencies in production processes and the development of innovative, eco-friendly solutions.

4.6.2 Green Dynamic Capability and Green Product Innovation

The second hypothesis of this study posits that green dynamic capabilities positively influence green product innovation. The analysis results provide strong support for this hypothesis, indicated by a p-value of 0.007, which is significantly below the 0.05 threshold, alongside a t-statistic value of 2.712, surpassing the critical threshold of 1.96. The results demonstrate a noteworthy beneficial effect. Consequently, green dynamic capability positively influences the enhancement of green

product innovation.

The results align with earlier studies by Borah et al. (2025), which demonstrated that green dynamic capabilities positively and significantly impact green product innovation. The research outlines that green-focused dynamic capabilities, encompassing operational, transactional, and technological development aspects, significantly promote the innovation of eco-friendly products to attain sustainable development. Additionally, the study by Zhu et al. (2023) reinforces this conclusion, revealing that the implementation of green technology and dynamic capabilities significantly enhances a company's capacity for green product innovation. This study highlights that organisations capable of identifying, leveraging, and reorganising resources demonstrate greater effectiveness in creating innovative, eco-friendly products.

The empirical evidence gathered from this study indicates that green dynamic capabilities significantly impact green product innovation. Green dynamic capabilities empower SMEs to recognise environmental opportunities, assimilate internal and external resources, and adjust organisational capabilities to develop innovative, eco-friendly, and sustainable products.

4.6.3 Green Market Orientation and Green Product Innovation

The third hypothesis of this study posits that a green market orientation positively influences green product innovation. The analysis results substantiate this hypothesis, presenting a p-value of 0.001, which

is below the 0.05 threshold, alongside a t-statistic value of 3.350, surpassing the minimum threshold of 1.96. The results demonstrate a noteworthy beneficial effect. Green market orientation positively influences the enhancement of green product innovation.

The results align with earlier studies by Sulaiman (2025), indicating that green market orientation positively and significantly influences green product innovation in MSMEs. Organisations that prioritise a robust approach to sustainability can effectively recognise and address the demands of consumers who are becoming more conscious of ecological concerns, thus fostering the development of innovative and environmentally friendly products. The findings of this study are further supported by the research conducted by Prakoso and Nugroho (2025), which indicates that market orientation, particularly with an emphasis on customer focus and cross-functional dimensions, positively and significantly influences green product innovation in SMEs. Furthermore, a study by Tjahjadi et al. (2020) revealed that a green market orientation positively influences green innovation, encompassing both products and processes. Adopting a green market orientation prompts companies to enhance product innovation, develop environmentally friendly offerings, and improve processes, while also reducing the adverse effects of business activities on the environment.

Multiple studies' findings provide empirical support that a green market orientation significantly impacts green product innovation.

Adopting a green market orientation allows small and medium-sized enterprises to understand the demands of customers who are becoming more environmentally aware, recognise sustainable market trends, and react by creating innovative, eco-friendly products.

4.6.4 Digital Technology Adoption and Sustainable Performance

The fourth hypothesis posits that the adoption of digital technology positively influences sustainable performance. This study's findings indicate that the hypothesis was supported, as evidenced by a p-value of 0.017, which falls below the 0.05 threshold, and a t-value of 2.391, exceeding the critical value of 1.96. In conclusion, the adoption of digital technology positively influences sustainable performance.

This finding aligns with earlier studies by Li et al. (2022), which demonstrated that the adoption of digital technology positively influences sustainable development performance in emerging strategic industries. The adoption of digital technology allows companies to enhance their incorporation of environmental, social, and governance (ESG) factors into their business practices. The study conducted by Wang and Wang (2025) corroborates this finding, demonstrating that the adoption of digital technology influences a company's ESG performance. The application of data analysis and advanced decision-making systems allows organisations to evaluate environmental risks and social responsibilities with greater efficacy. Consequently, organisations are more equipped to devise innovative strategies that promote sustainable

development.

Drawing from empirical evidence gathered across multiple studies, the findings of this study validate that the adoption of digital technology significantly impacts the sustainable performance of MSMEs. The integration of environmental, social, and governance aspects into business operations is significantly enhanced by digital technology, leading to the creation of sustainable value for companies.

4.6.5 Green Dynamic Capability and Sustainable Performance

The fifth hypothesis posits that green dynamic capabilities exert a beneficial influence on sustainable performance. This study's findings indicate that the hypothesis was supported, evidenced by a p-value of 0.000, which falls below the 0.05 threshold, and a t-value of 6.889, exceeding the critical value of 1.96. Consequently, it can be inferred that green dynamic capabilities positively influence sustainable performance.

This finding aligns with the conceptual study by Kiranantawat and Ahmad (2023), which explains that green dynamic capability enhances the sustainable performance of MSMEs both directly and indirectly. This study highlights that green dynamic capability allows companies to adjust to environmental changes, generate innovative green ideas, and organise processes to enhance environmental, social, and economic performance. Additionally, the study conducted by Weber et al. (2025) supports these conclusions across multiple industrial sectors, demonstrating that green dynamic capability can enhance sustainable

performance. Organisations capable of adapting their business processes and leveraging environmental insights sustainably will attain superior sustainable performance.

The findings of this study indicate that green dynamic capabilities significantly contribute to enhancing the sustainable performance of MSMEs. Green dynamic capabilities empower organisations to identify eco-friendly opportunities, assimilate and adjust resources, and foster innovation that aligns with enduring sustainability objectives.

4.6.6 Green Market Orientation and Sustainable Performance

The sixth hypothesis posits that a green market orientation positively influences sustainable performance. This study's findings indicate that the hypothesis was supported, as evidenced by a p-value of 0.025, which falls below the threshold of 0.05, and a t-value of 2.238, exceeding the critical value of 1.96. Consequently, it can be inferred that a green market orientation positively influences sustainable performance.

This finding aligns with Sulaiman's (2025) study, which demonstrates that a green market orientation directly enhances the sustainable performance of MSMEs by boosting responsiveness to green market demand and comprehension of environmental values, thereby promoting sustainable corporate practices. Adopting a green market orientation allows companies to collect insights regarding the preferences and expectations of eco-aware consumers, thus facilitating the development of strategies that align with environmental, social, and

economic objectives. Furthermore, findings from Tjahjadi et al. (2020) corroborate these results, indicating that green market orientation influences business performance. Adopting a green market orientation is crucial for organisations to tackle environmental awareness challenges and attain sustainable performance.

Drawing from the empirical evidence presented in these studies and the findings of this research, green market orientation significantly contributes to the sustainable performance of MSMEs. Understanding and responding to the demands of the green market is crucial for companies in crafting strategies and innovations that facilitate the attainment of sustainability objectives.

4.6.7 Green Product Innovation and Sustainable Performance

The seventh hypothesis posits that green product innovation positively influences sustainable performance. This study's findings indicate that the hypothesis was confirmed, as evidenced by a p-value of 0.000, which falls below the 0.05 threshold, and a t-value of 3.950, exceeding the critical value of 1.96. Consequently, it can be inferred that green product innovation positively influences sustainable performance.

This finding aligns with earlier studies by Sulaiman (2025), indicating that innovation in green products significantly enhances the sustainable performance of MSMEs by promoting greater resource efficiency, reducing environmental impact, and increasing economic value for companies. Organisations that prioritise the development of

sustainable products can effectively harmonise their environmental, social, and economic objectives. Research by Li et al. (2023) provides empirical evidence that green product innovation impacts corporate sustainability performance. The innovation of environmentally friendly products fosters the creation of corporate strategies and enhances employee motivation, ultimately propelling the company's long-term innovative performance.

The findings from this study indicate that innovation in green products significantly contributes to the sustainable performance of MSMEs. Focusing on environmental sustainability allows companies to generate mutual benefits for stakeholders, minimise their ecological footprint, and enhance their competitive edge by adopting sustainable business strategies.

4.6.8 Green Market Orientation and Sustainable Performance Mediated by Green Product Innovation

In the eighth hypothesis test, green product innovation serves as a mediating variable between green market orientation and sustainable performance. The preliminary hypothesis posits that green product innovation mediates the connection between green market orientation and sustainable performance. The data analysis results corroborate this hypothesis, with a p-value of 0.014 (below 0.05) and a t-statistic of 2.462 (exceeding 1.96). The results reveal that the hypothesis is validated, concluding that green product innovation serves as a complete mediator

in the relationship between green market orientation and the sustainable performance of MSMEs.

This finding aligns with Sulaiman's (2025) research, indicating that green product innovation serves as a complete mediator between green market orientation and sustainable performance in manufacturing SMEs. Green market orientation enables enterprises to recognise and comprehend the requirements of environmentally concerned consumers, hence fostering the creation of eco-friendly products that enhance sustainable performance. Research conducted by Tjahjadi et al. (2020) confirms the assertion that green innovation, encompassing product innovation, mediates the impact of green market orientation on business performance. Efficient green market orientation allows organisations to acquire green market intelligence, foster product innovations, and eventually attain superior environmental and economic outcomes.

Empirical evidence and the findings of this study indicate that green product innovation effectively mediates the relationship between green market orientation and sustainable performance. This mediation mechanism operates by converting green market knowledge and customer orientation into new eco-friendly products, thereby facilitating the attainment of sustainable economic, social, and environmental performance. Green product innovation acts as a catalyst that converts responsiveness to the green market into eco-friendly product development, therefore facilitating the attainment of sustainability

objectives.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This research examines the influence of digital technology adoption, green dynamic capabilities, green market orientation, and green product innovation on the sustainability performance of MSMEs in Yogyakarta. Data were collected from 105 MSME respondents using an online questionnaire and analysed with SmartPLS 4. The findings of the investigation lead to the following conclusions:

1. The adoption of digital technology positively and significantly influences green product innovation. The broader the use of digital technologies, including e-commerce platforms, social media, and cloud-based management systems, the more capable MSMEs become in creating innovative, ecologically sustainable products.
2. Green dynamic capabilities positively and significantly influence green product innovation. Consequently, MSMEs that engage in ongoing adaptation and learning regarding environmental factors can develop products with enhanced innovative and environmentally friendly characteristics.
3. Green market orientation positively and significantly influences green product innovation. MSMEs that effectively recognise green consumer opportunities and preferences can create products that align with sustainable market demands.

4. The adoption of digital technology significantly and positively impacts the sustainability performance of MSMEs. Digital technology improves operational efficiency, facilitates environmental tracking, and communicates environmentally friendly values to consumers, thereby improving sustainability performance.
5. Green dynamic capability positively and significantly influences Sustainability Performance. MSMEs that proactively manage green resources, innovate processes, and adapt environmental strategies tend to achieve better sustainability performance.
6. Green Market Orientation contributes positively and significantly to Sustainability Performance. Focusing on the green market segment encourages MSMEs to optimise business practices that are in line with sustainability principles.
7. Green product innovation positively and significantly impacts sustainability performance. Products developed with consideration for life cycle, eco-friendly materials, and resource efficiency improve the reputation and competitiveness of MSMEs sustainably.
8. Green product innovation mediates the relationship between green market orientation and the sustainability performance of MSMEs. Therefore, MSMEs in Yogyakarta with a green market orientation employ green product innovation as the primary mechanism to enhance their sustainability performance.

Overall, these findings emphasise the importance of synergy between digital technology, green capabilities, and green market orientation in driving green product innovation, which ultimately improves the sustainability performance of MSMEs in Yogyakarta.

5.2 Managerial Implications

1. The study's results indicate that the adoption of digital technology positively influences green product innovation. Consequently, MSME owners and managers in Yogyakarta must prioritise investments in digital technology, such as sustainable product design software, innovation collaboration platforms, product lifecycle management (PLM) systems, and big data analytics tools, to expedite the research and development process for more innovative, eco-friendly products that align with market demands.
2. Green dynamic capabilities have been proven to drive green product innovation significantly. SME managers need to develop internal capabilities, including rapid adaptation to environmental regulations, knowledge management related to sustainable practices, and the formation of cross-functional teams for new product research. Continuous training and collaboration with research institutions can strengthen these capabilities.
3. Green market orientation has a positive impact on green product innovation. MSMEs must actively understand the preferences and needs of green consumers through in-depth market research, online surveys,

focus group discussions, and monitoring of social media trends. This information is then processed into product innovation ideas that are not only environmentally friendly but also meet market expectations.

4. Adoption of digital technology enhances the sustainable performance of MSMEs. Utilising ERP systems for resource management, implementing carbon emission monitoring applications, and adopting paperless digital payment systems will improve operational efficiency, lower costs, and enable real-time reporting of environmental performance.
5. Green dynamic capability directly influences sustainable performance. Managers must strengthen organisational frameworks that facilitate green innovation, including dedicated sustainability units, internal environmental audit teams, and target-oriented incentive-penalty systems, to integrate green practices into corporate culture and ensure sustainable practices are incorporated throughout business processes.
6. Increased green market orientation directly correlates with improved sustainability performance. MSMEs should focus on communicating the benefits of environmentally friendly products, green certification, and sustainability narratives in their marketing efforts to enhance their reputation and strengthen customer loyalty, thereby supporting long-term growth.
7. Green product innovation has been proven to contribute directly to sustainable performance. MSMEs must allocate a special budget for research and development (R&D) of environmentally friendly products,

establish strategic partnerships with sustainable raw material suppliers, conduct pilot tests to ensure economic and environmental feasibility, and develop a diverse portfolio of environmentally friendly products to reach various market segments.

8. Green product innovation serves as a mediator between green market orientation and sustainable performance. Therefore, green market orientation tends to be more effective when combined with product innovation capabilities. MSMEs should align their market research processes with product innovation roadmaps, utilising sustainable innovation sprints that consistently incorporate consumer feedback into product development. This ensures that every green product launched truly contributes optimally to improving the economic, environmental, and social performance of MSMEs.

5.3 Research Limitations

1. This research utilised a sample of 105 MSMEs in Yogyakarta, determined through the application of the Slovin formula tailored to the specific context of the study. The sample size is adequate for model testing; however, the results cannot be universally applied to the MSME population in regions with varying economic and cultural contexts.
2. Data were collected online through a Google Forms questionnaire. This method made it easy for respondents to complete the questionnaire, but it had the potential to cause response bias due to careless filling out or misunderstanding of the questionnaire questions.

3. The research design was cross-sectional, which involves collecting data at one specific point in time. This method only captures the relationship between variables at the time of measurement and does not support the analysis of the dynamics or causality of variable changes over time.

5.4 Recommendations

1. Expanding the sample and geographical coverage by incorporating additional MSMEs across diverse regions, including those with varying economic and cultural contexts, aims to assess the consistency of variable relationships and enhance the generalisability of findings.
2. Combining quantitative methods (online questionnaires) with qualitative methods (interviews or focus group discussions) to enrich the description of the local context and reduce online bias.
3. Applying a longitudinal design with variable measurements at several points in time to dynamically monitor changes in trends and the causality of variable changes over time.

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APPENDICES

Appendix 1: Questionnaires

Section 1: Introduction

Assalaamu'alaikum Warahmatullahi Wabarakaatuh

Perkenalkan saya, Nailin Na'imah mahasiswa S1 Progam Studi Manajemen IUP angkatan 2021, Fakultas Bisnis dan Ekonomika, Universitas Islam Indonesia. Saat ini saya sedang melakukan penelitian tugas akhir terkait **Pengaruh Adopsi Teknologi Digital, Kapabilitas Teknologi Hijau, Orientasi Pasar Hijau, dan Inovasi Produk Hijau terhadap Kinerja Berkelanjutan Pada UMKM**. Sehubung dengan hal tersebut, dengan segala kerendahan hati saya mohon kesediaan Saudara/i meluangkan waktu untuk mengisi kuesioner penelitian ini sebagai data yang akan dilakukan dalam penelitian. Adapun kriteria responden yang dibutuhkan yaitu **pemilik atau manajer UMKM**.

Identitas serta jawaban Saudara/i yang diberikan akan terjamin kerahasiaannya dan hanya digunakan untuk kepentingan penelitian. Perlu Anda ketahui bahwa tidak ada jawaban yang benar atau salah dalam skala ini, sehingga Saudara/i diharapkan untuk mengisi setiap poin pernyataan sesuai dengan keadaan yang sebenar - benarnya.

Informasi yang Saudara/i berikan akan sangat bermanfaat dalam proses pengerjaan Tugas Saya. Atas kesediaan dan kesungguhan Saudara/i dalam pengisian skala penelitian ini, saya ucapkan terimakasih.

Jika anda memiliki kendala dalam pengisian kuisioner ini. Anda dapat menghubungi saya melalui WhatsApp 082137180161 (Nailin)

Section 2: Data Profil Responden

1) Nama Usaha (boleh inisial)
2) Jenis Kelamin Responden
    - Laki – laki
    - Perempuan
3) Usia Responden
    - < 25 tahun
    - 25 – 34 tahun
    - 35 – 44 tahun
    - 45 – 54 tahun
    - ≥ 55 tahun
4) Jabatan Responden
    - Pemilik Usaha
    - Manajer Usaha
5) Jenis Usaha UMKM
    - Fashion dan Tekstil
    - Manufaktur atau Industri Kecil
    - Furniture
    - Makanan dan Minuman
6) Umur Usaha
    - < 1 tahun
    - 1 – 5 tahun
    - 5 – 10 tahun
    - > 10 tahun
7) Omzet (Total pendapatan 1 tahun)
    - ≤ 300 Juta Rupiah
    - > 300 Juta sampai 2,5 Miliar Rupiah
    - > 2,5 Miliar sampai 50 Miliar Rupiah
8) Akses dan Penggunaan Teknologi Digital

- Smartphone
- Komputer/Laptop
- Internet
- Media Sosial
- Platform e-commerce

Section 3: Digital Technology Adoption

Pertanyaan-pertanyaan berikut memiliki 5 alternatif jawaban, silahkan tandai salah satu dari kelima pilihan jawaban tersebut:

1 = Sangat Tidak Setuju;

2 = Tidak Setuju;

3 = Netral;

4 = Setuju;

5 = Sangat Setuju

No	Pertanyaan
1	Ketersediaan akses internet di tempat kerja
2	Ketersediaan komputer/hp yang terhubung ke internet di tempat kerja
3	Menggunaan teknologi digital (misalnya, analitik, big data, cloud, media sosial, mobile) dalam transaksi bisnis
4	Menggunaan teknologi digital (misalnya, analitik, big data, cloud, media sosial, mobile) dalam operasional internal perusahaan
5	Investasi berkelanjutan dalam inisiatif berbasis teknologi digital (misalnya, analitik, big data, cloud, media sosial, mobile) untuk meningkatkan operasional
6	Teknologi digital mempercepat pengambilan perusahaa bisnis yang akurat

7	Pengelolaan pengetahuan terkait peluang bisnis, produk, proses, dan layanan didukung oleh penggunaan teknologi digital
8	Efisiensi dan kecepatan komunikasi informasi di dalam dan luar perusahaan melalui penerapan teknologi digital
9	Menerapkan alat digital dalam menganalisis data dari berbagai lini bisnis (R&D, produksi, dan layanan)

Section 5: Green Dynamic Capability

Pertanyaan-pertanyaan berikut memiliki 5 alternatif jawaban, silahkan tandai salah satu dari kelima pilihan jawaban tersebut:

1 = Sangat Tidak Setuju;

2 = Tidak Setuju;

3 = Netral;

4 = Setuju;

5 = Sangat Setuju

No	Pertanyaan
1	Perusahaan kami sering memantau permintaan pasar terhadap teknologi hijau untuk mengidentifikasi peluang pengembangan hijau baru
2	Perusahaan kami sering memantau pasar dan menganalisis dampak pengembangan teknologi hijau terhadap pelanggan
3	Perusahaan kami secara rutin meninjau aktivitas produksi hijau untuk memastikan sesuai dengan kebutuhan pelanggan
4	Perusahaan kami memiliki prosedur untuk mengembangkan pengetahuan hijau baru

5	Perusahaan kami mampu menyerap dan menerapkan pengetahuan hijau yang mereka temukan
6	Perusahaan kami dapat menerapkan pengetahuan hijau yang telah mereka pelajari ke dalam proses konstruksi yang sebenarnya
7	Perusahaan kami mampu menempatkan karyawan yang memiliki pengetahuan produksi hijau di posisi yang tepat sehingga keterampilan profesional mereka dapat dikembangkan lebih lanjut
8	Ketika perusahaan menerapkan produksi hijau, kami memastikan bahwa karyawan dapat memanfaatkan keahlian mereka secara optimal
9	Perusahaan kami mampu mengalokasikan sumber daya dengan sukses dan melaksanakan kegiatan inovasi teknologi hijau
10	Perusahaan kami dapat dengan cepat mengamati lingkungan dan mengenali peluang lingkungan baru.

Section 6: Green Market Orientation

Pertanyaan-pertanyaan berikut memiliki 5 alternatif jawaban, silahkan tandai salah satu dari kelima pilihan jawaban tersebut:

1 = Sangat Tidak Setuju;

2 = Tidak Setuju;

3 = Netral;

4 = Setuju;

5 = Sangat Setuju

No	Pertanyaan
1	Kepuasan pelanggan mendorong perusahaan kami untuk menjalankan bisnis yang ramah lingkungan.

2	Kami selalu berkomitmen untuk melayani pelanggan yang peduli terhadap produk ramah lingkungan.
3	Perusahaan kami menyediakan informasi tentang produk dan layanan ramah lingkungan kepada karyawan dan pelanggan.
4	Keunggulan kompetitif perusahaan kami ditentukan oleh pemahaman kami terhadap kebutuhan pelanggan yang peduli terhadap lingkungan.
5	Kami secara rutin mengukur kepuasan pelanggan berdasarkan atribut produk dan layanan ramah lingkungan.
6	Perusahaan kami memiliki departemen layanan pelanggan yang beroperasi secara rutin.
7	Kami mengalokasikan lebih banyak investasi untuk produk dan layanan ramah lingkungan dibandingkan pesaing kami.
8	Kami percaya bahwa bisnis ini ada untuk melayani pelanggan yang peduli terhadap lingkungan.
9	Informasi yang kami sediakan memudahkan pelanggan untuk menilai kualitas produk dan layanan ramah lingkungan.
10	Data kepuasan pelanggan secara rutin dikomunikasikan kepada semua karyawan.

Section 7: Green Product Innovation

Pertanyaan-pertanyaan berikut memiliki 5 alternatif jawaban, silahkan tandai salah satu dari kelima pilihan jawaban tersebut:

1 = Sangat Tidak Setuju;

2 = Tidak Setuju;

3 = Netral;

4 = Setuju;

5 = Sangat Setuju

No	Pertanyaan
1	Perusahaan kami menggunakan bahan baku ramah lingkungan dalam pengembangan produk.
2	Kami menggunakan bahan baku hemat energi dalam proses pengembangan produk.
3	Kami mengoptimalkan penggunaan bahan baku dalam proses produksi untuk mengurangi limbah.
4	Kami berinovasi untuk mengurangi penggunaan bahan baku tanpa mengorbankan kualitas produk.
5	Produk kami dirancang untuk dapat digunakan kembali, didaur ulang, dan secara alami dapat terurai.
6	Kami secara efektif mengurangi emisi berbahaya dan limbah dalam proses produksi.
7	Kami secara efektif mendaur ulang limbah dan emisi selama proses produksi.
8	Kami secara efektif mengurangi konsumsi air, listrik, dan bahan bakar dalam proses produksi.
9	Kami mengembangkan dan merancang kemasan ramah lingkungan, misalnya dengan menggunakan bahan yang dapat didaur ulang.

Section 8: Sustainable Performance

Pertanyaan-pertanyaan berikut memiliki 5 alternatif jawaban, silahkan tandai salah satu dari kelima pilihan jawaban tersebut:

1 = Sangat Tidak Setuju;

2 = Tidak Setuju;

3 = Netral;

4 = Setuju;

5 = Sangat Setuju

No	Pertanyaan
1	Perusahaan kami memberikan perhatian serius terhadap kesejahteraan tenaga kerja kami, seperti memberikan upah yang adil dan menciptakan lingkungan kerja yang sehat.
2	Perusahaan kami secara aktif berkontribusi pada pengembangan komunitas sekitar.
3	Kami membangun hubungan kerja sama jangka panjang dengan mitra bisnis di pasar.
4	Produk dan layanan yang kami hasilkan memberikan manfaat ekonomi bagi komunitas yang lebih luas.
5	Perusahaan kami beroperasi dalam jaringan bisnis yang mendukung pencapaian tujuan ekonomi berkelanjutan.
6	Bisnis kami dapat dianggap menguntungkan berdasarkan omzet tahunan.
7	Kami mampu bersaing dalam menarik dan mempertahankan pelanggan.
8	Bisnis kami memiliki pangsa pasar yang kompetitif.
9	Produk dan layanan yang kami tawarkan tidak merusak lingkungan.
10	Kami menerapkan kebijakan bertanggung jawab dalam penggunaan bahan dan energi.

11	Dalam operasional kami, kami berupaya menggunakan teknologi ramah lingkungan sebanyak mungkin.

Appendix 2: Raw Data Tabulation by Variable

- **Digital Technology Adoption**

DTA1	DTA2	DTA3	DTA4	DTA5	DTA6	DTA7	DTA8	DTA9
4	5	4	4	4	5	4	4	4
5	5	5	5	5	5	5	5	5
3	3	3	3	3	5	3	3	3
3	4	4	2	4	4	3	4	4
5	5	5	5	5	5	5	5	2
5	4	4	4	4	4	5	5	2
5	5	5	5	5	4	4	4	3
4	4	4	4	4	4	4	4	5
4	4	3	4	3	5	3	3	3
3	3	2	2	5	4	5	2	2
4	4	3	3	5	4	4	3	3
5	5	5	5	3	5	5	5	5
4	4	3	5	4	5	4	3	3
4	4	4	5	3	4	4	3	3
5	5	5	2	5	5	5	5	5
5	5	5	2	5	5	5	5	5
3	4	5	4	4	4	5	5	4
5	5	2	5	5	5	5	5	5
4	4	2	3	4	5	4	4	4
4	4	2	3	4	4	4	4	4
5	5	3	5	4	5	5	5	4
4	2	5	5	5	5	5	5	5
5	5	5	5	5	4	5	5	3
4	4	5	5	4	5	5	4	5
5	5	3	3	4	5	5	3	3
4	5	4	5	4	5	5	5	4
4	5	4	4	4	5	5	5	5

5	5	5	5	4	5	4	4	5
4	4	3	3	2	3	3	3	2
5	5	5	5	5	5	5	5	5
2	3	2	2	3	3	4	2	2
5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5
2	3	3	3	4	4	4	4	4
4	4	4	4	5	4	4	4	4
4	4	4	4	4	5	5	4	4
5	5	4	3	3	4	2	2	2
1	3	5	3	5	3	5	5	5
5	4	4	4	5	5	5	5	5
5	5	5	5	5	4	4	4	4
4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5
5	5	4	4	4	5	4	4	4
5	5	5	5	5	5	5	1	5
5	5	5	5	3	4	4	3	2
5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5
5	5	5	4	4	4	4	3	4
5	5	5	5	5	5	5	4	5
4	3	3	3	4	3	3	3	3
5	5	5	5	5	5	5	5	5
4	4	4	4	5	5	5	3	4
5	5	5	5	5	5	5	5	5
3	4	3	3	3	3	3	3	3
5	5	5	5	5	5	5	5	5

5	5	5	5	5	5	5	5	5
5	5	4	5	5	4	5	5	5
5	4	3	3	3	3	4	4	3
4	4	4	4	4	4	4	3	4
5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	4	5	4
5	5	5	4	4	4	4	4	3
5	5	5	5	3	3	3	3	4
5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5
4	4	5	4	5	5	5	5	4
5	5	5	5	5	4	5	4	4
5	4	5	4	5	5	4	5	4
5	5	5	4	4	5	5	4	4
5	5	5	5	4	5	4	4	5
3	4	3	4	4	4	4	4	4
5	4	4	5	5	4	5	4	4
4	4	4	4	4	5	4	4	4
2	2	3	2	2	2	2	2	3
2	3	3	3	2	2	2	3	2
5	4	5	5	5	5	4	5	5
3	2	2	2	3	3	3	3	2
3	3	2	2	2	2	2	3	2
2	3	3	3	3	4	3	3	3
2	2	3	2	2	2	2	3	3
5	5	5	5	5	5	5	4	5
5	5	4	5	5	5	5	4	5
5	4	5	4	5	4	5	5	5
5	5	4	5	4	5	4	5	5

5	5	5	5	5	4	4	5	5
5	4	5	5	5	5	5	5	4
3	3	2	2	3	3	3	2	3
5	5	5	5	5	5	5	4	5
5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5
5	5	5	4	5	5	4	5	5
2	3	2	2	3	2	3	2	2
3	3	3	2	2	2	2	2	3
2	3	2	2	3	2	3	3	3
3	3	4	3	4	4	4	3	4
4	4	4	4	5	4	4	4	3
2	3	3	3	2	2	2	3	3
5	5	5	5	5	5	5	4	4
5	4	5	5	4	5	5	4	4
3	4	4	4	3	3	3	4	3

- **Green Dynamic Capability**

GDC1	GDC2	GDC3	GDC4	GDC5	GDC6	GDC7	GDC8	GDC9	GDC10
3	3	3	3	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	2
3	3	3	3	3	3	3	5	3	3
4	2	4	4	5	4	5	2	3	4
4	4	4	4	5	5	3	5	4	5
5	5	5	5	5	2	5	5	2	5
3	4	3	3	5	3	3	3	5	3
4	4	4	4	2	4	4	4	2	4
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5	4	4	2	4	4	4	2	4	4
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2	4	2	4	5	4	5	2	5	5
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2	5	5	5	5	5	2	5	5	5
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5	5	5	5	5	5	5	5	5	5
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5	5	5	5	5	5	5	5	5	5
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3	4	4	3	4	3	4	4	4	4
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4	3	3	3	4	4	5	5	5	5
4	5	5	4	5	3	5	5	5	5
2	2	3	2	2	2	2	3	3	2
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- **Green Market Orientation**

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- **Green Product Innovation**

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- **Sustainable Performance**

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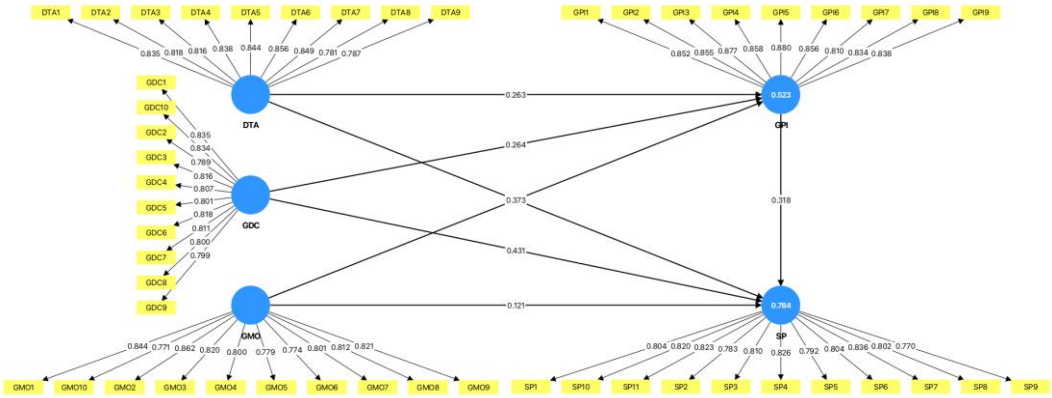
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3	3	4	3	3	3	4	4	4	3	3
3	4	4	4	4	4	3	3	4	4	4
3	2	3	2	2	2	3	3	2	2	2
5	5	5	4	5	5	5	5	5	5	5
4	4	3	4	4	4	4	4	3	4	4
5	5	4	5	5	4	4	4	4	4	4

Appendix 3: PLS-SEM Test

- **Outer Loadings**



- **Average Variance Extracted (AVE)**

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
DTA	0.941	0.942	0.951	0.681
GDC	0.942	0.943	0.951	0.658
GMO	0.941	0.943	0.950	0.654
GPI	0.952	0.953	0.960	0.725
SP	0.946	0.947	0.953	0.651

- **Cross Loadings**

	DTA	GDC	GMO	GPI	SP
DTA1	0.835	0.402	0.418	0.477	0.561
DTA2	0.818	0.446	0.333	0.496	0.529
DTA3	0.816	0.522	0.430	0.516	0.615
DTA4	0.838	0.463	0.352	0.450	0.581
DTA5	0.844	0.446	0.405	0.501	0.554
DTA6	0.856	0.386	0.358	0.488	0.565
DTA7	0.849	0.412	0.416	0.517	0.503
DTA8	0.781	0.435	0.410	0.449	0.531
DTA9	0.787	0.419	0.323	0.383	0.598
GDC1	0.398	0.835	0.339	0.434	0.626
GDC10	0.420	0.834	0.400	0.543	0.640
GDC2	0.435	0.789	0.363	0.442	0.582
GDC3	0.520	0.816	0.366	0.451	0.663
GDC4	0.401	0.807	0.306	0.398	0.686
GDC5	0.410	0.801	0.320	0.419	0.581
GDC6	0.426	0.818	0.254	0.436	0.651
GDC7	0.381	0.811	0.259	0.403	0.589
GDC8	0.443	0.800	0.299	0.482	0.609
GDC9	0.463	0.799	0.367	0.481	0.593
GMO1	0.328	0.340	0.844	0.471	0.478
GMO10	0.325	0.304	0.771	0.472	0.450
GMO2	0.343	0.322	0.862	0.503	0.465
GMO3	0.388	0.427	0.820	0.518	0.537
GMO4	0.376	0.349	0.800	0.534	0.509
GMO5	0.402	0.313	0.779	0.476	0.481
GMO6	0.354	0.285	0.774	0.399	0.357
GMO7	0.390	0.321	0.801	0.534	0.478
GMO8	0.416	0.303	0.812	0.446	0.467
GMO9	0.429	0.287	0.821	0.489	0.477
GPI1	0.435	0.420	0.598	0.852	0.665
GPI2	0.435	0.459	0.473	0.855	0.599
GPI3	0.588	0.458	0.534	0.877	0.608
GPI4	0.455	0.460	0.468	0.858	0.609
GPI5	0.483	0.519	0.465	0.880	0.650
GPI6	0.455	0.490	0.496	0.856	0.627
GPI7	0.587	0.481	0.510	0.810	0.698
GPI8	0.505	0.463	0.467	0.834	0.634
GPI9	0.461	0.497	0.587	0.838	0.655
SP1	0.557	0.613	0.414	0.608	0.804
SP10	0.602	0.589	0.510	0.655	0.820
SP11	0.471	0.594	0.484	0.532	0.823
SP2	0.523	0.643	0.391	0.556	0.783
SP3	0.545	0.694	0.515	0.608	0.810
SP4	0.540	0.660	0.497	0.580	0.826
SP5	0.522	0.625	0.473	0.585	0.792
SP6	0.594	0.583	0.457	0.644	0.804
SP7	0.563	0.628	0.498	0.610	0.836
SP8	0.573	0.628	0.476	0.668	0.802
SP9	0.523	0.548	0.469	0.614	0.770

- **Cronbach's Alpha**

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
DTA	0.941	0.942	0.951	0.681
GDC	0.942	0.943	0.951	0.658
GMO	0.941	0.943	0.950	0.654
GPI	0.952	0.953	0.960	0.725
SP	0.946	0.947	0.953	0.651

- **Collinearity VIF**

	DTA	GDC	GMO	GPI	SP
DTA				1.553	1.698
GDC				1.456	1.603
GMO				1.334	1.626
GPI					2.097
SP					

- **Coefficient of Determination Test (R-Square)**

	R-square	R-square adjusted
GPI	0.523	0.509
SP	0.784	0.776

- **Q-Square**

	Q^2predict
GPI	0.474
SP	0.703

- **Path Coefficients/Hypothesis Testing**

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
DTA -> GPI	0.263	0.260	0.116	2.261	0.024
DTA -> SP	0.211	0.220	0.088	2.391	0.017
GDC -> GPI	0.264	0.257	0.097	2.712	0.007
GDC -> SP	0.431	0.430	0.063	6.889	0.000
GMO -> GPI	0.373	0.382	0.111	3.350	0.001
GMO -> SP	0.121	0.121	0.054	2.238	0.025
GPI -> SP	0.318	0.308	0.081	3.950	0.000