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STRATEGIES FOR BUSINESS SUSTAINABILITY THROUGH DIGITAL MARKETING AND INNOVATION IN ASPIRING GEOPARK

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Abstract: This study explores the impact of digital marketing on business sustainability through geoproduct innovation among Micro, Small, and Medium-sized Enterprises (MSMEs) in the Aspiring Geopark Pangandaran. While previous research has examined geoproduct development and its contributions to local livelihoods, limited studies have addressed the relationship between digital marketing, geoproduct innovation, and MSME sustainability in a geopark setting. This research aims to fill this gap by employing a quantitative approach. Data were collected from 100 MSMEs through an online questionnaire, and the Structural Equation Modeling-Partial Least Squares (SEM-PLS) method was applied for hypothesis testing, given its suitability for small sample sizes. The study reveals that geoproduct innovation, particularly eco-friendly product development, plays a crucial role in business growth by attracting environmentally conscious consumers. Additionally, digital marketing significantly influences geoproduct innovation strategies, enhancing their impact on business performance. The integration of digital marketing with geoproduct innovation fosters long-term sustainability for MSMEs operating within geopark regions. The findings suggest that leveraging digital marketing tools can optimize geoproduct promotion, improve market reach, and strengthen customer engagement. Furthermore, the study highlights the need for MSMEs to adopt digital strategies to remain competitive in an evolving business landscape. By incorporating geoproduct innovation into marketing efforts, MSMEs can enhance brand positioning and expand market opportunities. These insights offer valuable implications for policymakers, business owners, and stakeholders in geopark territories. Strengthening digital marketing initiatives and innovation strategies will ensure the resilience and sustainability of MSMEs, contributing to economic growth and environmental conservation. This study underscores the strategic importance of integrating digital marketing with geoproduct innovation in fostering sustainable MSME development within geoparks.

Keywords: digital marketing, geoproduct innovation, business sustainability, Aspiring Geopark Pangandaran

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INTRODUCTION

Geoparks serve as hubs for sustainable development, integrating geological, ecological, and cultural heritage into cohesive frameworks that support local economies and preserve natural resources. Geotourism, a prominent feature of geoparks, emphasizes responsible tourism practices that balance environmental conservation with cultural appreciation (Šambronská et al., 2023). Within this context, micro, small, and medium enterprises (MSMEs) play a vital role by offering products and services that showcase local heritage, thereby connecting visitors with the region's unique attributes (Miśkiewicz, 2024). However, while geoparks present significant opportunities for community development and environmental stewardship,

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ensuring the long-term sustainability of MSMEs operating within these areas remains a persistent challenge. Sustainability in the context of MSMEs extends beyond environmental considerations to include economic resilience and social responsibility. As key players in the geopark ecosystem, MSMEs contribute to the local economy through employment, innovation, and cultural preservation. Geoproducts - items or services inspired by a geopark's natural and cultural resources - emphasize the integration of local identity and environmental education into tourism offerings (Hermawati et al., 2020; Miśkiewicz, 2024). Despite their potential, many MSMEs face barriers to scaling their operations and maintaining competitiveness in a dynamic market. Addressing these challenges requires innovative marketing strategies that leverage digital technologies to enhance visibility, engagement, and customer loyalty (Muis et al., 2024; Purba et al., 2021). Geoproducts and MSME sustainability was explored independently, the intersection of these topic, particularly the role of digital marketing in driving geoproduct innovation within geopark has received limited academic attention. Geoparks such as Aspiring Geopark Pangandaran exemplify the need for integrated approaches that foster innovation while promoting responsible tourism. Research indicates that digital marketing offers MSMEs a means to adapt to evolving consumer preferences and market demands, thereby ensuring their sustainability (Kasavan et al., 2017; Mahajan, 2023; Lestari et al., 2023). Yet, the application of these strategies in the geopark context remains underexplored, particularly in regions with significant geotourism potential.

Digital marketing, characterized by its ability to amplify reach and engagement, is transforming the way MSMEs operate in geoparks. By utilizing platforms like social media, businesses can establish direct connections with consumers, showcase their unique offerings, and enhance brand visibility (Anyadighibe et al., 2024). These tools not only provide cost-effective marketing solutions but also facilitate the integration of sustainability principles into business practices. For instance, MSMEs that align their digital marketing strategies with responsible tourism practices can attract environmentally conscious consumers and bolster their reputation (Kasavan et al., 2017). However, for these benefits to materialize, MSMEs must adopt a multifaceted approach that combines innovation, marketing, and community engagement.

Innovation plays a central role in the sustainability of MSMEs, enabling them to develop unique products and services that cater to both local and tourist markets. Geoproducts, as highlighted in recent studies, represent a novel strategy for enhancing competitiveness by leveraging local resources and cultural heritage (Retnaningsih et al., 2024; Pratiwi et al., 2022). Continuous product development and creative marketing strategies allow MSMEs to differentiate themselves in a competitive market with environmental challenges, ensuring long-term resilience (Olazo, 2022). Despite the recognized benefits of digital marketing and innovation, their application within the geopark setting remains fragmented. For instance, studies on MSMEs in Indonesia highlight the role of entrepreneurial orientation in improving marketing performance through digital channels (Anyadighibe, 2024). A study by Fiona et al. (2024) indicate a positive correlation between effective digital marketing practices and improved performance metrics for MSMEs. This includes increased sales, customer engagement, and overall business growth. However, these insights often lack specific focus on the unique context of geoparks, where environmental and cultural considerations intersect with business operations. Similarly, while partnerships between MSMEs and geopark management are acknowledged as valuable for resource sharing and joint marketing initiatives, their implementation remains inconsistent (Sánchez-Cortez et al., 2024). These gaps underscore the need for comprehensive strategies that integrate marketing, innovation, and sustainability to address the specific challenges faced by MSMEs in geoparks.

The literature provides a foundation for understanding the potential of digital marketing and innovation in enhancing MSME sustainability within geoparks. For instance, studies have shown that training programs focused on entrepreneurial competencies can empower MSME operators to implement effective marketing strategies and adapt to changing market conditions (Ibrahim et al., 2021; Noverani et al., 2023). Furthermore, community involvement in geotourism initiatives fosters a sense of ownership and responsibility towards sustainable practices, creating synergies that benefit both local businesses and the environment (Hermawati et al., 2020). However, these findings also highlight the need for context-specific approaches that address the unique characteristics of geoparks and their associated MSMEs.

This study aims to bridge these gaps by exploring how digital marketing influences geoproduct innovation and contributes to the sustainability of MSMEs in Aspiring Geopark Pangandaran. By focusing on this specific geopark, the research provides novel insights into the integration of marketing and innovation strategies within a geotourism framework. The study's findings will inform both practitioners and policymakers, offering practical recommendations for enhancing business performance while preserving the natural and cultural heritage of geoparks. This approach not only addresses the identified research gaps but also contributes to the broader discourse on sustainable development in geoparks. Through this investigation, the study seeks to advance the understanding of how MSMEs can leverage digital tools to achieve economic resilience and environmental stewardship, ultimately supporting the sustainable growth of geotourism.

MATERIALS AND METHODS

In the theoretical framework of this study, several key theories and frameworks provide a foundation for understanding how digital marketing and geoproduct innovations contribute to the sustainability of MSMEs in the Aspiring Geopark Pangandaran. Innovation Diffusion Theory, developed by Everett Rogers, elucidates how, why, and at what rate new ideas and technologies spread through cultures. This is supported by findings who emphasize the role of cultural similarity in the acceptance of innovations within communities (Giraldo et al., 2024). This theory is used to examine the adoption of digital marketing strategies and geoproduct innovations by MSMEs, as it highlights the roles of early adopters and opinion leaders in gaining traction for these innovations. is particularly relevant in the context of geoparks, where the adoption of innovative practices and technologies can significantly impact environmental management, tourism, and community engagement.

The Resource-Based View (RBV) of the firm further complements this perspective by positing that firms can achieve a competitive advantage through the strategic utilization of unique resources and capabilities. In this context, digital

marketing and innovation serve as critical resources that enable MSMEs to differentiate themselves and achieve sustainability. Additionally, sustainability frameworks such as the Triple Bottom Line (TBL) and the Sustainable Development Goals (SDGs) provide a comprehensive lens through which MSMEs can balance economic, social, and environmental objectives. These frameworks underscore the importance of integrating sustainability into business practices, aligning with the study's focus on enhancing business sustainability within geoparks. These theories and frameworks offer a robust foundation for exploring the interplay between digital marketing, innovation, and sustainability in the context of MSMEs. A conceptual framework was developed to illustrate the integration of variables emphasizing how digital marketing strategies and innovative practices contribute to the long-term sustainability of MSMEs.

Digital Marketing

Digital marketing is a tool for reaching targeted customers with pertinent marketing messages and promotional offers. Due to its simplicity and affordability, digital marketing is now accessible to even small business owners. Digital marketing consisted of social media-based strategies, collaboration with influencers, customized content, and understanding of consumer perspectives for marketing success (Mishra et al., 2022). MSME digital marketing are analyzed from the aspects of: skills, technology, security, and creative content (Phalle, 2021). Digital marketing variables are measured based on the effectiveness of using digital platforms.

Innovation Strategies

The innovation strategy outlined in (Couñago-Blanco et al., 2024) study focuses on aligning innovation efforts with consumer perceptions and readiness for adoption. A robust innovation strategy integrates consumer insights with adaptive, consumer-focused innovation processes. MSME innovation strategies focus on technology-based sustainable practices, including innovation, collaboration, communication, and commitment, to increase competitiveness, brand loyalty, and market value (Wibowo et al., 2023). Geoproduct innovation strategy is measured based on the utilization of local potential in products.

Business Sustainability

Sustainable business models generally emphasize creating economic, social, and environmental value while aligning business practices with customer needs and preferences. This approach helps MSMEs establish long-term resilience and competitive advantage through sustainable practices (Zimmer et al., 2023) MSME business sustainability customer segmentation, environmental value proposition, online distribution channels, personalized customer relationships, and revenue from product or service sales. Business sustainability is measured from three dimensions: social, economic, and environmental.

METHOD

The study utilized the quantitative method, where the variables are: digital marketing, innovation strategies and business sustainability. The study starts with gathering literature review form journal articles and study reports, then designing the research questions and design. The research instrument were developed to collect the data from respondents, then data processing and analysis is conducted. The steps in methodology are shown in Figure 1.

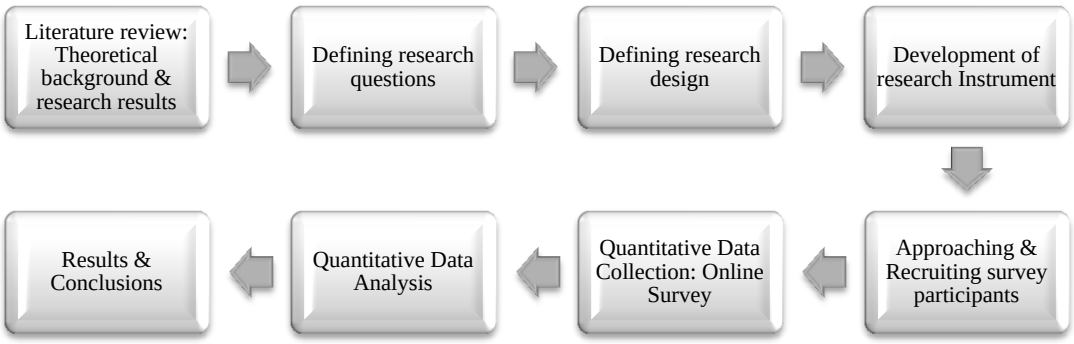

Figure 1. Steps in Research Methodology

Study Location

Aspiring Geopark Pangandaran located in West Java Province of Indonesia is a prime example of a sustainable tourism destination that integrates geodiversity, biodiversity, and cultural diversity. Its geological richness, including sedimentary, volcanic, and alluvial formations, coupled with unique landforms such as karst hills and coastal plains, showcases the region's significant scientific and educational value. Biodiversity thrives in its ecosystems, with mangrove forests and coastal habitats supporting endemic species while enabling eco-tourism activities like body rafting and river tubing. Additionally, Pangandaran's cultural heritage, reflected in traditional arts, cultural villages, and local customs, enhances its appeal by offering visitors experience of nature. These elements collectively create a strong foundation for developing sustainable geotourism, fostering environmental conservation, community empowerment, and cultural preservation, ensuring long-term benefits for both the local population and visitors.

The list of Aspiring Geopark Pangandaran's geosites are as follows: 1.Pangandaran beach, 2. Ciwayang Rafting, 3. Batukimpang,4. Lanang Cave, 5.Jojogan, 6.Papedan Hill, 7.Green Canyon,8. Batu Cave, 9.Cicurug River, 10.Madasari

Salt Mine, 11. Jojongor beach, 12. Madasari Beach, 13.Situ Cisamping, 14.TPI Palatar Agung, 15.Krapyak Beach,16. Karang Tirta Beach,17.Panenjoan Fossil Hill, 18. Haur Mountain, 19.Curug Leuwiutak, 20.Sutra Reregan Cave, 21.Santirah, 22. Upper reaches of Ciljulang River, 23.Cijumleng Doline. For more details refer to the map in Figure 2.

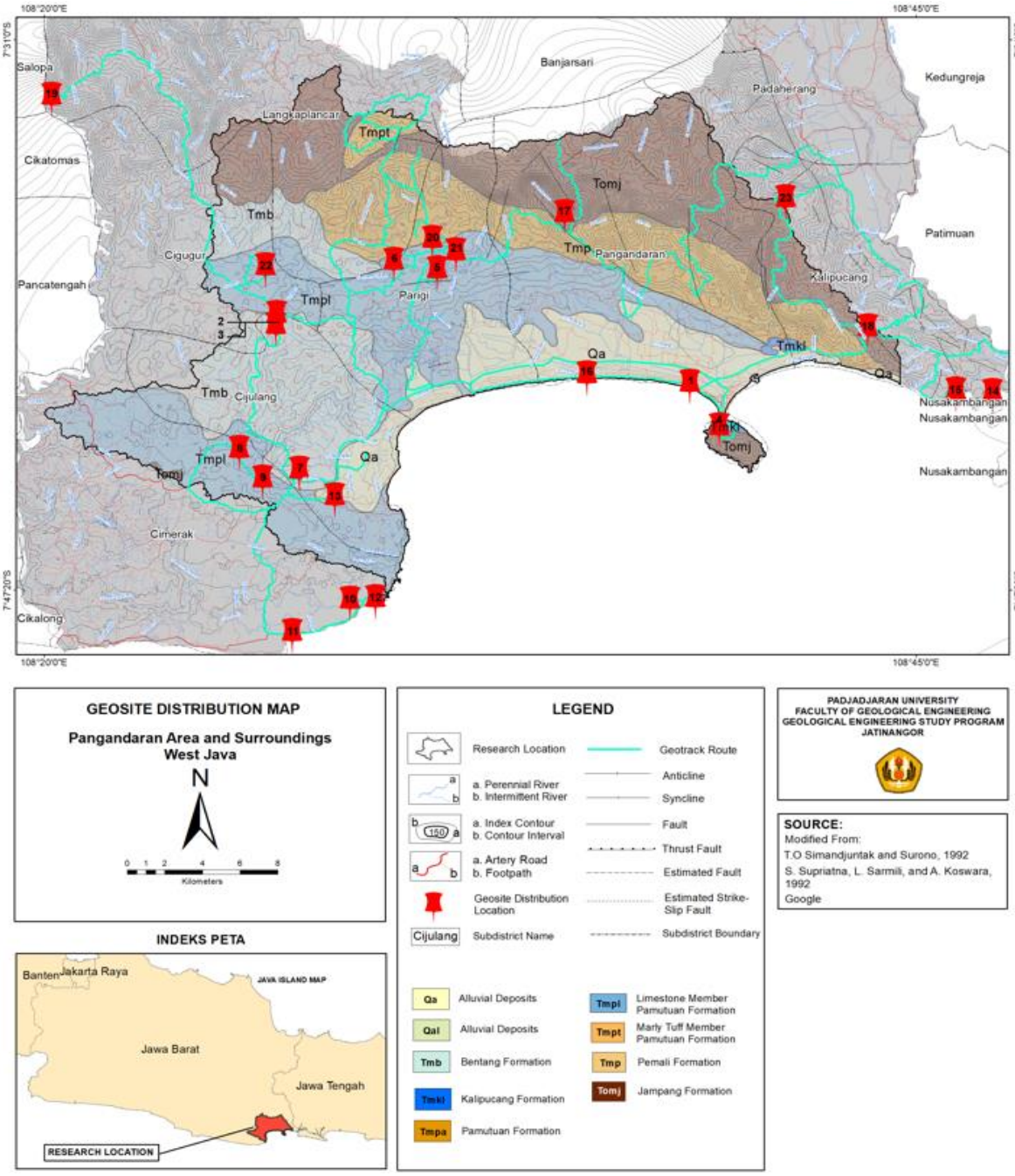

Figure 2. Map of Aspiring Geopark Pangandaran

Aspiring Geopark Pangandaran as natural tourist destinations is rich in natural beauty and geological uniqueness is classified as a geosite. The categories of geosites are based on natural forms, including beaches, rivers, caves, karst, landscapes, and fossils, including megafauna fossils such as megalodon. The park has the following category of geosites:

1. Beaches Pangandaran is known for its beautiful beaches and high tourist appeal. The beaches in Pangandaran serve as geosites that showcase geological phenomena related to sedimentation and erosion processes. Some famous beaches include: Pangandaran Beach (curved coastline and waves suitable for surfing), West and East Pangandaran Beach (West Beach more exposed to large waves)
2. Rivers in Pangandaran have distinctive geomorphological characteristics. The rivers in this region are formed by erosion and deposition by water flowing through mountainous and karst areas. Several rivers that are geosites include: Citanduy River, Cijulang River (natural scenery with high cliffs and surrounding caves).
3. The caves in Pangandaran are the result of limestone dissolution by water containing carbonic acid. These caves often form in karst areas that are abundant in this region. The well-known caves include: Pananjung Cave (stalactite and stalagmite formations), Kera Cave (unique rock formations and habitat for monkeys).

4. Karst a landscape formed by limestone dissolution by water and Pangandaran has many very interesting karst areas, both geologically and aesthetically. These karst areas show natural phenomena that can be deep geological study objects. Several well-known karst areas in Pangandaran include: Pananjung Karst (unique landscapes, such as steep cliffs, caves, and underground river flows), and Ciamis Karst (distinctive morphology with many caves, dolines, and springs) .
5. The landscape in Pangandaran includes various natural formations formed through geological processes such as erosion, sedimentation, and tectonics. Some interesting landscapes in Pangandaran include: cliffs on the West Coast (morphology resulting from erosion creating g natural formations often used as geological research objects), Karst Hill (overview of dynamics of soil formation influenced by limestone dissolution and other geological processes).
6. The fossils in Pangandaran such as the Megalodon fossil are a valuable find in paleontological studies. These fossils show traces of ancient marine life that once lived in the waters around Pangandaran during prehistoric times. Megalodon is a giant shark that was the dominant predator in the oceans during the Miocene to Pliocene epochs. Some sites in Pangandaran, especially those near the coast, have found megalodon tooth fossils that can be used to understand the evolution of ancient marine species and changes in the marine environment over millions of years. The discovery of megalodon tooth fossils is evidence that this area was once part of an ancient marine habitat. These fossils are very important for paleontological studies because they provide information about past geological and biological conditions.

Data

This study used an online survey method. The population and sample of this study consists of MSMEs located in the Aspiring Pangandaran Geopark. A representative sample of 100 MSMEs have been collected out of 200 questionnaires distributed online. Purposive sampling was used to select Micro, Small, and Medium Enterprises (MSMEs) that operate within Aspiring Geopark Pangandaran. This study adhered to ethical research practices, including informed consent from all participants. The online survey method was deemed appropriate as it allowed the study to focus on MSMEs directly involved in geoproduct development and active in digital marketing. Such businesses were selected to capture unique geotourism dynamics and their alignment with the sustainability objectives of the geopark. The selection criteria included MSMEs engaged in geoproduct innovation, active use of digital marketing platforms such as social media or e-commerce, and a minimum operational experience of five years. These criteria ensured the inclusion of enterprises with sufficient maturity and relevance to the study's objectives. According to (Sekaran & Bougie, 2020) purposive sampling is used in research that requires sample selection based on certain criteria that are relevant to the research objectives (Sekaran & Bougie, 2020). The demographic profile of the selected MSMEs was particularly relevant to the research due to their active involvement in the geopark's geotourism framework. These enterprises were characterized by a focus on locally inspired geoproducts, reliance on digital marketing for visibility, and operations aligned with sustainable tourism practices. Such characteristics made them ideal subjects for exploring the integration of digital marketing, geoproduct innovation, and business sustainability within a geopark context. Figure 3 indicates that many respondents (38%) are in their productive age between 31-40 years old. Based on the online survey data, the majority of respondents education are high school degree (51%), and most respondents have currently more than 15 people working at their MSMEs (92%).

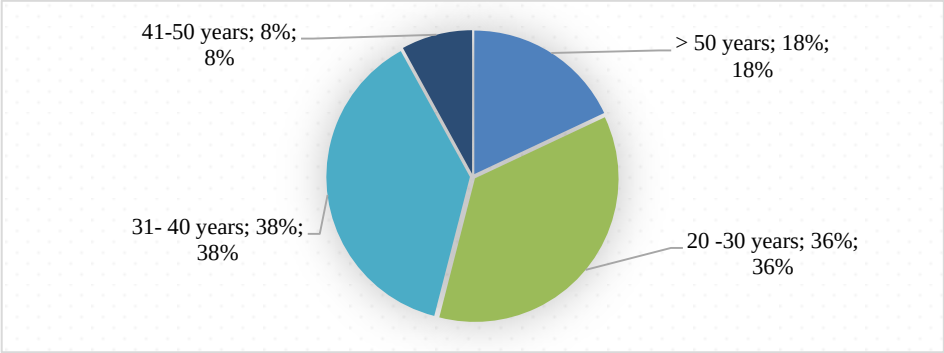

Figure 3. Age Profile of MSMEs Owner

Questionnaire design

Research data were collected through a survey using a Likert scale-based questionnaire. The Likert scale is used to measure the level of respondent agreement with statements related to research variables on 5-point Likert scales ranging from 1=strongly disagree to 5=strongly agree. There was a total of 21 questions in total where digital marketing has six questions, innovation strategies 10 questions, and 5 questions related to business sustainability.

Data - Analysis techniques

To ensure the reliability and validity of the data, several measures were undertaken. The questionnaire used in this study was pretested with a subset of 30 MSMEs to identify and address any ambiguities, thereby improving clarity and usability. Triangulation methods were also employed, with data cross-verified through interviews, observations, and document analysis to enhance credibility. Internal consistency was assessed using Cronbach's alpha, yielding a value of 0.85, which indicated a high level of reliability. These steps collectively ensured that the data collected was robust and reflective of the dynamics being studied. For estimating the measurement and structural models, the researchers apply Partial Least Squares

(PLS). This technique has several advantages over covariance-based models structural equation modelling (SEM) models (Sarstedt, 2019; Shmueli, 2019): (1) higher convergence due to its simplicity; (2) predictive applications; (3) better suited for small sample studies (less than 250 cases); and (4) better suited for formative construct analysis.

This method has been applied in numerous research to estimate formative and reflective first- and second-order models (Cepeda-Carrion, 2019; Sarstedt, 2020). Smart PLS was the program used to model the PLS. The significance test was conducted using the bootstrapping technique, which creates a standard error value distribution by employing a replacement value to generate a predetermined number of samples that are the same size as the original sample.

This study conducted data validity and reliability tests (Table 1). The research findings revealed that digital marketing includes six indications with an alpha score of 0.907. Furthermore, innovation strategy has ten indicators with an alpha score of 0.909, whilst competitiveness has four indications with an alpha score of 0.826. All structures were trustworthy.

Table 1. Loading factor for each measurement variable

Variables and Indicators	Factor Loadings	Cronbach's Alpha
Digital Marketing		0.907
Customer relationships	0.793	
Usage of digital media	0.874	
Digital marketing strategies	0.810	
Digital marketing channels.	0.878	
Communicate product sustainability	0.874	
Digital marketing for the sustainable growth	0.723	
Innovation Strategy		0.909
Optimalization of resources	0.648	
Innovate new products or services.	0.791	
Environmentally friendly practices.	0.763	
Environmental commitment to consumers.	0.763	
Product promotions	0.761	
Price of the product or service is affordable	0.729	
Product packaging environmentally friendly	0.839	
Environmentally friendly information	0.733	
Work safety culture in daily operations.	0.795	
Savings in the production process.	0.585	
Business Sustainability		0.826
Repurchased products in the last 3 years.	0.670	
Community service activities	0.686	
Comply to regulations on environmental friendliness	0.816	
Saved energy (water, electricity, and gas) for the last 3 years.	0.789	
Reduce costs of processing business waste	0.874	

Table 2. Result of Hypotheses Testing

Research Hypothesis	Relationship Between Construct	Coefficient	t count	CR	P Value	Information Research Hypothesis
$H_{1:}$ Digital Marketing influenced Innovation Strategy	X → M	0.698	12,993	1.96	0.000	H_a Accepted
$H_{2:}$ Digital Marketing influenced Business Sustainability	X → Y	0.295	2,594		0.010	H_a Accepted
$H_{3:}$ Innovation Strategy influenced Business Sustainability	M → Y	0.514	4,884		0.000	H_a Accepted
$H_{4:}$: Digital Marketing through Innovation Strategy influenced Business Sustainability	X → M → Y	0.358	4.281		0.000	H_a Accepted

RESULTS AND DISCUSSIONS

To achieve the research purpose, the sampling unit were evaluated and the results used preset criteria. The study employed MSMEs as owners who have integrated digital marketing in their businesses. The fieldwork was completed in a short amount of time, with a focus on the July-August 2024 school holiday season, when Aspiring Geopark Pangandaran welcomed many tourists and MSMEs were actively marketing their products/services. This method aimed to ensure relevance to queries about specific events and enhance answer consistency.

Statistic Result

The basis for testing the hypothesis is the values contained in the output results for inner weight. In PLS, statistical testing of each hypothesized connection is performed using simulation, and in this case, the bootstrapping method is employed. Bootstrapping is used to minimize issues related to the abnormality of research data. The results, along with the t-statistic values obtained from the bootstrapping process. Based on the Table 2, it can be concluded as digital marketing (X) has a significant positive effect on geoproduct innovation strategy (M) with a coefficient direction of 0.698, t count 12.993 > 1.96 with a significance level of 0.000 < 0.05. Thus, the first hypothesis (H1) in this study is accepted (Ho is rejected and Ha is accepted). Digital marketing (X) has a significant positive effect on business sustainability (Y) with a coefficient direction of 0.295, t count 2.594 > 1.96 with a significance level of 0.0010 < 0.05. Thus, the second hypothesis (H2) in this study is accepted (Ho is rejected and Ha is accepted). Geoproduct innovation strategy (M) has a significant positive effect on business sustainability (Y) with a coefficient direction of 0.514, t count 4.884 > 1.96 with a significance level of 0.000 < 0.05.

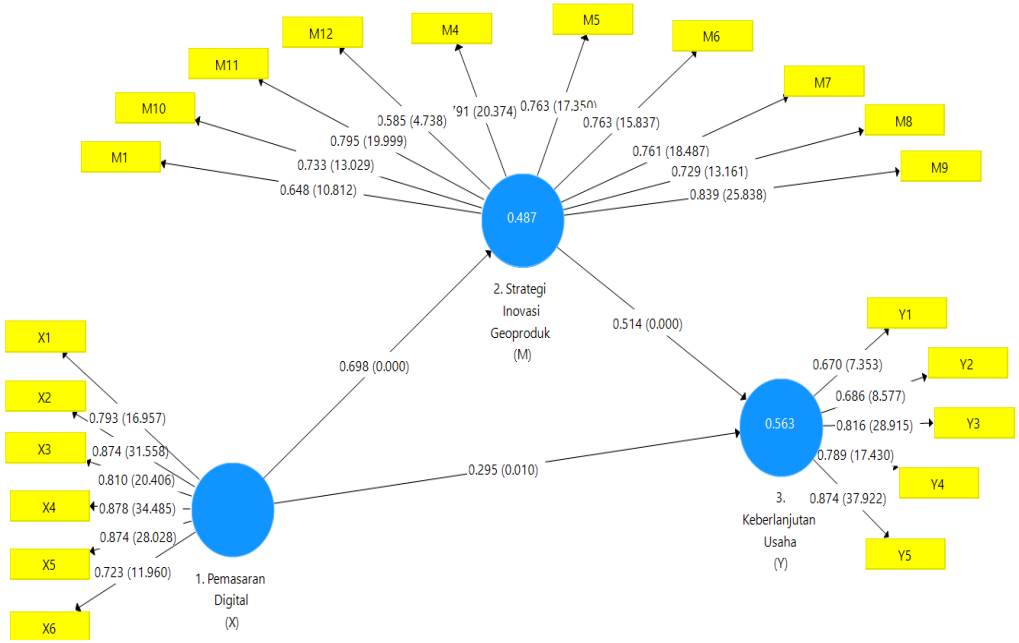

Figure 4. Research Framework

The third hypothesis (H3) in this study is accepted (Ho is rejected and Ha is accepted). Digital marketing (X) has a significant positive effect on business sustainability (Y) through geoproduct innovation strategy (M) with a coefficient direction of 0.358, t count 4.281 > 1.96 with a significance level of 0.000 < 0.05. The fourth hypothesis (H4) in this study is accepted (Ho is rejected and Ha is accepted) (Figure 4). Meanwhile, the results of the total influence of the innovative digital marketing approach model to improve the sustainability performance of Geoproduct MSMEs in the Aspiring Geopark Pangandaran can be presented in the following Table 3.

Table 3. Total effect result

Relationship between Constructs	Effect			t value	P Value	95% CIBC	
	Direct	Indirect	Total			2.5%	97.5%
X → M	0.698	-	0.698	12,993	0.000	0.570	0.785
X → Y	0.295	0.358	0.653	11,031	0.000	0.509	0.751
M → Y	0.514	-	0.514	4,884	0.000	0.298	0.710

Based on the table above, information on the total influence of each exogenous predictor that has been tested provides significant results ($p < 0.05$, 95% CIBC $\neq 0$). This means that digital marketing is a predictor that has the strongest relative total influence on the innovation strategy of MSME geoproducts in the Aspiring Geopark Pangandaran. Additionally, hypothesis testing results indicate that the geoproduct innovation strategy mediates the impact of digital marketing on business sustainability. In other words, MSMEs who not only adopt digital marketing but also combine it with environmentally friendly innovation are more successful in achieving business sustainability. The indirect effect coefficient of 0.358 indicates that geoproduct innovation plays a key role in ensuring that digital marketing efforts are translated into long-term sustainability.

The analysis revealed key relationships among digital marketing, geoproduct innovation, and business sustainability for MSMEs in the Aspiring Geopark Pangandaran. Hypothesis 1 (H1) was supported, with a strong path coefficient of 0.698 ($p < 0.001$), indicating a significant positive influence of digital marketing on geoproduct innovation. This emphasizes the transformative potential of digital strategies in driving innovation, enabling MSMEs to create geoproducts that cater to evolving consumer demands. Hypothesis 2 (H2) also demonstrated a significant positive effect, with a coefficient of 0.652 ($p < 0.01$), affirming that geoproduct innovation enhances business sustainability. This finding underscores the role of innovative practices in ensuring the long-term viability of MSMEs by aligning their offerings with sustainable and responsible tourism principles. Hypothesis 3 (H3) confirmed the mediating role of geoproduct innovation in linking digital marketing to business sustainability, with a mediating effect coefficient of 0.456 ($p < 0.05$). Tables 2 and 3 provide detailed statistical results and group comparisons, highlighting differences in performance across MSMEs based on their digital marketing intensity and innovation adoption. These insights demonstrate that higher levels of digital marketing and innovation adoption lead to significantly greater business sustainability outcomes. The strong relationship between digital marketing and geoproduct innovation (0.698) aligns with findings from Muis (2024) and Purba et al. (2021), who identified digital platforms as essential tools for fostering innovation. This study extends these insights by highlighting the specific mechanisms through which digital marketing drives innovation in the unique context of geoparks. MSMEs in this study benefited from leveraging social media and online platforms to promote geoproducts, reaching environmentally conscious consumers and enhancing their market presence.

The positive impact of geoproduct innovation on business sustainability (0.652) resonates with research by Retnaningsih (2024) and Pratiwi et al. (2022), which emphasized the importance of developing locally inspired, sustainable products. This study builds on this literature by demonstrating that innovative practices contribute to sustainability not only

by meeting consumer preferences but also by preserving the cultural and geological heritage of geoparks. The mediating role of geoproduct innovation (0.456) bridges gaps in existing studies, such as those by Lestari et al. (2023), which have emphasized the indirect pathways connecting marketing strategies to sustainability outcomes. By integrating innovation into the marketing-sustainability framework, this study provides a cohesive model for MSMEs aiming to thrive in geopark settings.

To summarize key insights from Tables 2 and 3, MSMEs that scored high in digital marketing intensity and geoproduct innovation adoption exhibited significantly improved sustainability metrics compared to those with lower scores. For example, high-intensity adopters reported increased consumer engagement, higher revenue stability, and a stronger alignment with sustainable tourism objectives.The results of the study show that digital marketing plays an important role in supporting the sustainability of MSME businesses, especially in the geoproduct sector in the Aspiring Geopark Pangandaran area. The use of digital media, such as social media and e-commerce platforms, allows business actors to reach a wider audience at a more efficient cost. The high loading factor for using digital channels to reach target consumers (X4) demonstrates how essential creative marketing strategies are in geopark marketing, which relies not only on a geosite's physical allure but also on effectively reaching a broader audience (Table 1).

Digital marketing allows for broader access and sparks greater interest in local products through a narrative-driven approach. Geotourism development goes beyond environmental conservation, demanding a deep understanding of visitors' preferences for destination products and services (Šambronská et al., 2023). Furthermore, the strategic use of social media marketing has positively affected MSMEs, helping them reach more customers and foster loyalty affordably (Fu et al., 2024). Interaction and communication through digital media enable business actors to better understand customer needs and adapt their marketing strategies dynamically. This aligns with research highlighting digital technology's essential role in expanding market reach and building consumer loyalty. By allowing companies to diversify services, digital technology broadens market access and fosters customer loyalty across regions. Furthermore, digital marketing facilitates global reach, encourages purchasing behavior, and supports loyalty through cost-effective interactions (Vladimirovna & Viktorovna, 2022; Bordoloi & Bhardwaj, 2020)

CONCLUSION

The findings of this study underscore the critical role of digital marketing and geoproduct innovation in enhancing the sustainability of MSMEs within the Aspiring Geopark Pangandaran. By leveraging digital marketing tools, MSMEs can achieve higher visibility and engagement with environmentally conscious consumers, fostering the development of innovative geoproducts that align with sustainable tourism principles. The strong mediating effect of geoproduct innovation demonstrates that sustainability outcomes are best achieved through a synergistic approach combining marketing strategies and innovative practices. From a practical perspective, MSME actors should prioritize adopting digital marketing platforms, such as social media and e-commerce, to expand their market reach and engage directly with consumers. Training programs emphasizing digital competencies, content creation, and data analytics can equip MSMEs to maximize their marketing potential. Concurrently, fostering innovation through collaborative networks, such as partnerships with Geopark management, can lead to the creation of distinctive products that reflect local heritage and appeal to niche markets.

Policymakers and local governments play a pivotal role in facilitating this transformation. Providing infrastructure support, such as internet access and digital literacy programs, is essential for enabling MSMEs to adopt digital marketing effectively. Additionally, policies promoting responsible tourism, capacity-building initiatives, and financial incentives for sustainable practices can create an enabling environment for MSMEs to thrive. Future research could explore the role of government interventions and public-private partnerships in scaling digital marketing adoption among MSMEs. Examining consumer behavior in response to digital marketing efforts within geopark settings could provide deeper insights into optimizing marketing strategies. Furthermore, longitudinal studies assessing the long-term impacts of digital marketing and innovation on sustainability metrics would contribute to a comprehensive understanding of this dynamic.

This study has limitations, where the sample was restricted to MSMEs in a single aspiring geopark, which may limit the generalizability of findings to other contexts. Additionally, the cross-sectional design precludes an analysis of temporal effects or causal relationships. Addressing these limitations in future research could enhance the robustness of the evidence base.

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