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Payment Gateways, Green Financing, and Sustainability Innovation in Islamic Economics for MSMEs and SDGs

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Abstract

Objective: This study aims to examine the integration of payment gateways, green financing, and sustainability innovation in improving MSME performance, while exploring their contribution to the achievement of the United Nations Sustainable Development Goals (SDGs), particularly those related to inclusive economic growth and sustainable business practices. **Theoretical framework:** This research is grounded in the perspective of sustainable development and digital financial innovation, which views digital payment systems, environmentally responsible financing, and sustainability-driven innovation as key elements in enhancing MSME competitiveness and resilience. This framework is linked to the SDGs agenda, particularly goals related to decent work and economic growth, responsible consumption and production, and partnerships for sustainable development. **Literature review:** Previous studies have highlighted the important role of digital financial technology in improving transaction efficiency and financial inclusion for MSMEs. Other studies emphasize the significance of green financing in supporting environmentally responsible business activities, as well as the role of sustainability innovation in strengthening business competitiveness and long-term resilience in the global economy. **Method:** This study employs a quantitative research approach using survey data collected from MSME owners and managers. The analysis focuses on examining the relationships between payment gateway adoption, green financing access, sustainability innovation, and MSME performance through statistical modeling techniques to obtain a comprehensive understanding of the proposed research model. **Results:** The findings indicate that payment gateway adoption, green financing, and sustainability innovation positively influence MSME performance. Digital payment systems improve transaction efficiency and market accessibility, green financing supports environmentally sustainable business investments, and sustainability innovation enhances product competitiveness and long-term business sustainability. These elements collectively contribute to strengthening MSME development in line with the SDGs agenda. Therefore, integrating digital financial technology, green financing, and sustainability innovation within an Islamic economic framework may provide a holistic approach to improving MSME performance. **Implications:** This research highlights the importance of integrating digital financial technology, sustainable financing, and innovation in MSME development strategies. The findings also support policy

initiatives aimed at improving digital infrastructure, expanding access to green financing, and promoting sustainability-oriented business practices to strengthen MSME competitiveness while supporting the SDGs agenda. **Novelty:** The novelty of this study lies in the integration of payment gateways, green financing, and sustainability innovation within a comprehensive analytical framework to examine their combined impact on MSME performance while linking MSME development with the achievement of the United Nations Sustainable Development Goals.

Keywords: payment gateway, green financing, sustainability innovation, islamic economics, sdgs.

INTRODUCTION

Business sustainability has become a global priority in the modern economic landscape as countries seek to balance economic growth, environmental protection, and social welfare [1]. In this context, Micro, Small, and Medium Enterprises (MSMEs) play a crucial role in supporting inclusive economic development and employment creation [2]. According to the World Bank, MSMEs represent more than 90% of businesses worldwide, employ around 70% of the global workforce, and contribute approximately 50% of global Gross Domestic Product (GDP) [3]. However, despite their strategic contribution, many MSMEs still face major challenges in adapting to digital transformation and sustainable business practices. These challenges are increasingly relevant in the global development agenda promoted by the United Nations Sustainable Development Goals (SDGs), particularly Goal 8 (Decent Work and Economic Growth), Goal 9 (Industry, Innovation, and Infrastructure), and Goal 12 (Responsible Consumption and Production) [4].

In Indonesia, MSMEs constitute the backbone of the national economy. Recent data indicate that Indonesia has more than 66 million MSMEs, representing 99.9% of all business units and contributing more than 61% to the national GDP while employing over 119 million workers [5]. Despite this significant contribution, the transformation toward sustainable and digital business practices among MSMEs remains limited [6, 7]. Many small businesses still rely on conventional business models and have not fully adopted digital financial technologies or environmentally responsible production processes [8]. This condition highlights the urgency of strengthening MSME capacity in adopting innovative and sustainable business strategies [9].

One important aspect of MSME transformation is the adoption of digital financial technologies, including payment gateways [10]. Digital payment systems enable faster, safer, and more efficient financial transactions while expanding market access for small businesses [11]. However, studies show that many MSMEs still demonstrate relatively low digital literacy, where digital platforms are often used only for basic promotion through social media rather than for integrated financial management or digital payment systems such as QR-based payments, e-wallets, or online payment gateways [12].

Another critical challenge relates to access to green financing. Green financing plays an important role in supporting environmentally responsible investments and encouraging businesses to adopt sustainable production practices [13]. Nevertheless, green financing initiatives in Indonesia are still largely dominated by large-scale projects such as renewable energy infrastructure, green housing, and electric vehicles [14]. As a result, MSMEs often face barriers in accessing green financial instruments due to limited financial literacy, managerial capacity, and collateral requirements. This situation creates a significant gap in supporting MSMEs to transition toward environmentally sustainable business models.

From the perspective of Islamic economics, sustainable business practices are closely aligned with the principles of justice (*adl*), social welfare (*maslahah*), and environmental stewardship (*khalifah*) [15]. Islamic economic principles emphasize ethical financial transactions, responsible resource management, and long-term social benefits. In this

context, Islamic financial instruments such as sharia-compliant financing, profit-sharing mechanisms, and ethical investment frameworks can support MSME development while promoting sustainability [16]. Therefore, integrating digital financial technology, green financing, and sustainability innovation within an Islamic economic framework offers a promising pathway to strengthen MSME performance and resilience.

At the regional level, Central Java Province represents one of the main centers of MSME growth in Indonesia. Government data show that more than 140,000 MSMEs operate in the province, with Surakarta contributing a significant proportion of these enterprises [17]. The Solo Raya region, which includes Surakarta, Sukoharjo, Klaten, Karanganyar, Sragen, Boyolali, and Wonogiri, hosts hundreds of thousands of MSME units operating in sectors such as culinary businesses, fashion, and handicrafts [18]. These sectors have strong potential to integrate digital financial systems, sustainable production practices, and environmentally friendly innovations to increase competitiveness and business resilience.

Despite this potential, MSMEs in the Solo Raya region continue to face several critical challenges [19]. First, the adoption of digital technologies remains relatively low, particularly in the use of digital payment systems and financial technology platforms. Second, access to green financing remains limited due to insufficient financial literacy and institutional support. Third, sustainable innovation among MSMEs is still minimal, as many businesses focus primarily on short-term survival rather than long-term sustainability strategies such as energy efficiency, waste management, or circular economy practices [20].

Previous studies have generally examined these issues separately. Some studies emphasize the role of digital finance in improving MSME transaction efficiency, while others focus on the challenges of green financing access or the limited adoption of sustainability-oriented innovation [21]. However, limited research has integrated these three factors simultaneously within a single analytical framework, particularly within the context of Islamic economics and local MSME development.

Therefore, this study aims to examine the integration of payment gateways, green financing, and sustainability innovation within an Islamic economic framework in improving MSME performance [22]. By linking these elements to the broader agenda of the United Nations Sustainable Development Goals, this research seeks to provide a comprehensive understanding of how digital finance, sustainable investment, and innovation can jointly strengthen MSME competitiveness while supporting sustainable economic development.

LITERATURE REVIEW

MSME Performance and Sustainable Development

Micro, Small, and Medium Enterprises (MSMEs) play a strategic role in economic development, particularly in developing countries. MSMEs contribute significantly to employment generation, poverty reduction, and economic growth [23]. However, their performance is often constrained by limited access to finance, low technological capability, and insufficient innovation capacity. In the context of global development, strengthening MSME performance has become an important component of achieving the United Nations Sustainable Development Goals (SDGs), especially Goal 8 (Decent Work and Economic Growth), Goal 9 (Industry, Innovation, and Infrastructure), and Goal 12 (Responsible Consumption and Production). Improving MSME performance through innovation, financial inclusion, and sustainable practices is therefore essential to promote inclusive and resilient economic growth.

Payment Gateways and Digital Financial Inclusion

Digital financial technology has transformed the way businesses conduct financial transactions. One of the most important innovations in this area is the payment gateway system, which allows businesses to process electronic payments efficiently and securely. Payment gateways enable MSMEs to accept multiple forms of digital payments, including credit cards, e-wallets, and QR-based transactions, thereby improving transaction efficiency and expanding market access [24]. Studies indicate that the adoption of digital payment systems can increase operational efficiency, reduce transaction costs, and improve customer satisfaction. For MSMEs, digital payment adoption also facilitates integration with online marketplaces and digital platforms, which can significantly enhance business competitiveness in the digital economy.

Green Financing and Sustainable Business Development

Green financing has emerged as an important financial mechanism to support environmentally responsible investments and sustainable economic development. Green financing refers to financial instruments or funding mechanisms that prioritize projects with positive environmental impacts, such as energy efficiency, renewable energy, sustainable production, and waste management [25]. For MSMEs, access to green financing can provide opportunities to adopt environmentally friendly technologies and production processes. However, previous studies indicate that many MSMEs still face difficulties in accessing green financing due to limited financial literacy, lack of collateral, and insufficient awareness of sustainable financial instruments. Expanding green financing access is therefore essential to encourage MSMEs to transition toward sustainable business models.

Sustainability Innovation in MSMEs

Sustainability innovation refers to the development of new products, processes, or business models that integrate economic performance with environmental and social responsibility [26]. For MSMEs, sustainability innovation may include eco-friendly production processes, resource efficiency, waste reduction, and the adoption of circular economy practices. Such innovations not only reduce environmental impacts but also enhance long-term business competitiveness. Research suggests that businesses that adopt sustainability-oriented innovations tend to achieve better financial performance, improved brand reputation, and stronger resilience in dynamic market environments.

Islamic Economics and Sustainable Business Practices

Islamic economics provides an ethical and value-based framework for economic activities, emphasizing justice (adl), social welfare (maslahah), and environmental responsibility. Islamic financial principles promote fair transactions, risk-sharing mechanisms, and the avoidance of exploitative practices such as interest (riba). In the context of sustainable development, Islamic economics encourages responsible resource management and the protection of the environment as part of the concept of human stewardship (khalifah). Islamic financial instruments, including profit-sharing financing models such as mudharabah and musyarakah, can support MSME development while promoting ethical and sustainable economic practices [27]. Therefore, integrating digital financial technology, green financing, and sustainability innovation within an Islamic economic framework may provide a holistic approach to improving MSME performance.

Although previous studies have examined the role of digital finance, green financing, and sustainability innovation in MSME development, most research has addressed these factors separately. Limited studies have attempted to integrate these three elements simultaneously within a single analytical framework, particularly from the perspective of Islamic economics. Furthermore, empirical research examining the combined influence of

payment gateways, green financing, and sustainability innovation on MSME performance remains limited, especially in regional contexts where MSMEs play a crucial role in local economic development. This study seeks to address this gap by developing an integrated model that examines the relationships among digital payment systems, sustainable financing, and sustainability innovation in improving MSME performance while supporting the achievement of the United Nations Sustainable Development Goals.

METHODOLOGY

This study employed a quantitative explanatory approach to analyze the relationships between payment gateway adoption, access to green financing, sustainable innovation, and MSME performance in the Solo Raya region. The research population consisted of owners and managers of creative economy MSMEs (culinary, fashion, and handicrafts), with purposive sampling applied as the sampling technique [28]. The selection criteria included owning or managing a creative business in Solo Raya and having adopted at least one of the key factors under investigation. A total of 100 valid responses were collected, which aligns with the recommendation that a sample size of more than 100 is adequate for multivariate analysis using PLS-SEM [29].

The research instrument was developed based on relevant literature: payment gateway adoption [30], access to green financing [31], sustainable innovation, and MSME performance [32]. All constructs were measured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Data were collected through an online survey distributed via WhatsApp and email using Google Forms. The data analysis was conducted with Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4.0. Model evaluation included the outer model (convergent validity with outer loading ≥ 0.7 and AVE ≥ 0.5 ; discriminant validity with HTMT < 0.85 ; and reliability with CR and Cronbach's Alpha ≥ 0.7) and the inner model (R^2 , Q^2 , and path significance assessed through bootstrapping with 5,000 subsamples at a significance level of $p < 0.05$) [33].

RESULTS AND DISCUSSION

Respondent Description

Table 1. Respondent Description

No	Gender	Frequency	Percent
1	Male	86	86 %
2	Female	14	14 %
	Total	100	100 %
No	Business Owner Age	Frequency	Percent
1	< 20 years	0	0 %
2	20-30 years	17	17 %
3	31-40 years	63	63 %
4	>40 years	20	20 %
	Total	100	100 %
No	Length of Business Establishment	Frequency	Percent
1	< 1 year	9	16 %
2	1-5 years	39	39 %

3	6-10 years	41	41 %
4	> 10 years	11	11 %
	Total	100	100 %
No	Last Educational Level	Frequency	Percent
1	Junior High School	7	7 %
2	Senior High School/ Vocational High School	46	46 %
3	Diploma	19	19 %
4	Bachelor's Degree	28	28 %
	Total	100	100 %

The majority of MSMEs in this study were male (86%), predominantly aged 31–40 years (63%), indicating they were of productive age with extensive business experience. Most had been running their businesses for 6–10 years (41%) and 1–5 years (39%), indicating sufficient entrepreneurial experience. In terms of education, the majority were high school/vocational school graduates (46%), followed by bachelor's degrees (28%), diplomas (19%), and junior high school degrees (7%). Despite their relatively limited formal education, they were able to manage their businesses and adapt to digital payments, access to green financing, and sustainable innovation. These findings highlight the need for capacity building through business training and mentoring.

Quantitative analysis

Outer Model

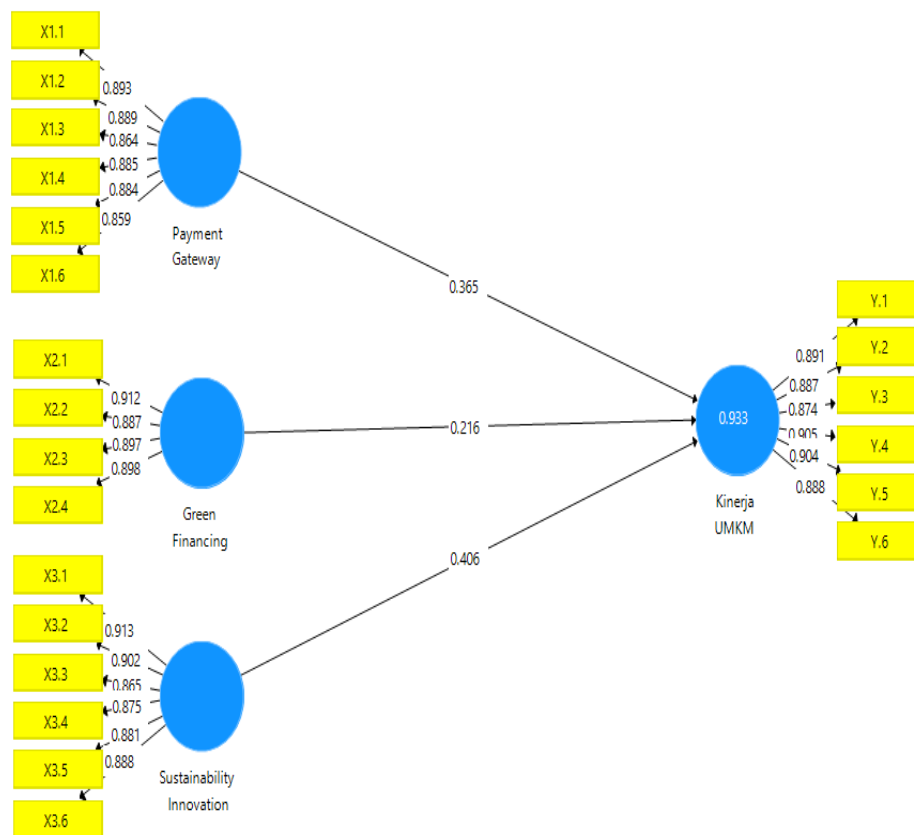


Figure 1. Outer Model

Outer Model Analysis

Convergent Validity

Table 2. Outer Loading Value

No	Variable	Indicator	Outer Loading
1	Payment Gateway (X1)	X1.1	0,893
		X1.2	0,889
		X1.3	0,864
		X1.4	0,885
		X1.5	0,884
		X1.6	0,859
2	Green Financing (X2)	X2.1	0,912
		X2.2	0,887
		X2.3	0,897
		X2.4	0,898
3	Sustainability Innovation (X3)	X3.1	0,913
		X3.2	0,902
		X3.3	0,865
		X3.4	0,875
		X3.5	0,881
		X3.6	0,888
4	MSME performance (Y)	Y.1	0,891
		Y.2	0,887
		Y.3	0,874
		Y.4	0,905
		Y.5	0,904
		Y.6	0,888

Table 2 shows that all indicators have outer loadings above 0.7, meeting the convergent validity criteria. Payment Gateway (X1) has the highest value at 0.893 (X1.1) and the lowest at 0.859 (X1.6). Green Financing (X2) has a high correlation of 0.887–0.912, Sustainability Innovation (X3) has a high correlation of 0.861–0.888, and MSME Performance (Y) has a high correlation of 0.888–0.904. All indicators are suitable for use in subsequent analyses.

Table 3. Validity and Reliability of Research Variable Constructs

No	Variable	AVE	Composite Reliability	Cronbachs Alpha	MSME performance
1	Payment Gateway (X1)	0,773	0,953	0,941	3,428
2	Green Financing (X2)	0,807	0,944	0,920	2,897
3	Sustainability Innovation (X3)	0,787	0,957	0,946	3,524
4	MSME performance (Y)	0,795	0,959	0,948	

Table 3 shows that all research variables have AVE values > 0.5 , Composite Reliability > 0.9 , and Cronbach's Alpha > 0.9 , proving the instrument is valid and reliable.

Furthermore, the VIF values for all variables are < 5.0, thus eliminating multicollinearity issues. Therefore, the research instrument is suitable for measuring the influence of payment gateways, green financing, and sustainability innovation on MSME performance.

Inner Model Analysis

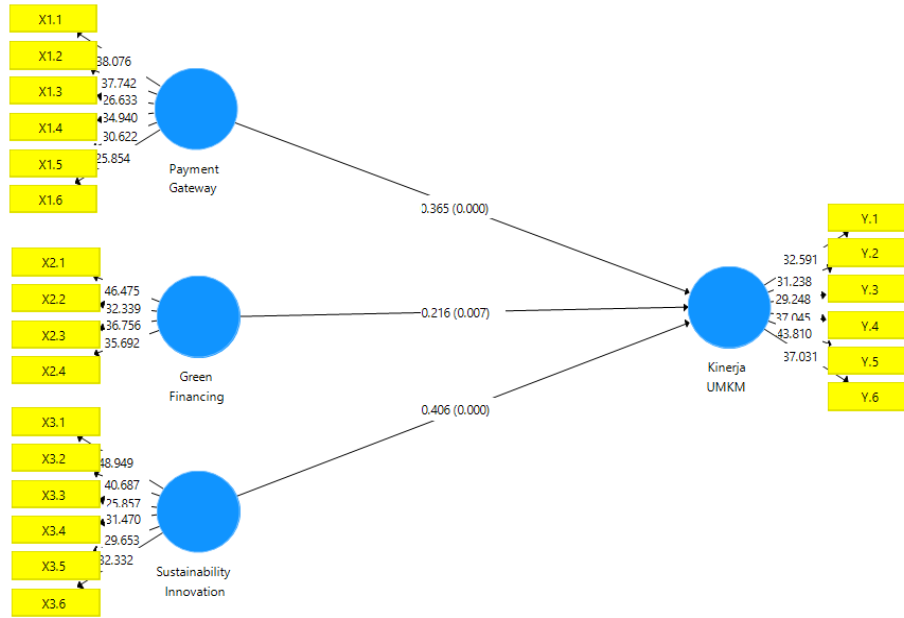


Figure 2. Inner Model

Table 4. R-Square Value

No		R-Square
1	MSME performance	0.933

Hypothesis testing

Table 5. Path Coefficient (Direct Effect)

No	Hypothesis	Original Sample	t-Statistics	P Values	Description	
1	Payment Gateway (X1) -> MSME performance (Y)	H1	0,365	4,705	0,000	Positive Significant
2	Green Financing (X2) -> MSME performance (Y)	H2	0,216	2,697	0,007	Positive Significant
3	Sustainability Innovation (X3) -> MSME performance (Y)	H3	0,406	5,369	0,000	Positive Significant

The results of this study indicate that the three independent variables, namely Payment Gateway, Green Financing, and Sustainability Innovation, have a positive and significant influence on MSME performance. Payment Gateway is proven to increase transaction efficiency and market access, which ultimately has a direct impact on improving business performance. The original sample value of 0.365 with a t-statistic of 4.705 and a p-value of 0.000 confirms that its influence is significant. Green Financing contributes to business sustainability because environmentally friendly financing support can strengthen the

resilience of MSMEs. The original sample value of 0.216 with a t-statistic of 2.697 and a p-value of 0.007 confirms the importance of access to green financing. Sustainability Innovation shows the strongest influence with an original sample value of 0.406, a t-statistic of 5.369, and a p-value of 0.000. This innovation not only encourages resource efficiency but also increases competitiveness through environmentally friendly products and processes. These three results consistently demonstrate that digital technology adoption, green financing, and sustainable innovation complement each other in strengthening MSME performance. Thus, this research model emphasizes the importance of integrating these three variables as a comprehensive strategy.

Qualitative analysis

Interview results regarding the implementation of digital payment systems (payment gateways) indicate that all respondents have integrated this method into their businesses. The reasons given varied, but were generally influenced by consumer demands and digital market trends. Some respondents began using payment gateways due to requests from customers from outside their region who needed a practical payment method. Others were driven by the COVID-19 pandemic, which accelerated the shift to cashless transactions. Others decided to implement after participating in digital marketing training from the Department of Trade. Cooperative networks also accelerated the adoption of digital payment systems among some businesses. In general, the most frequently cited reasons were ease of transactions, better financial records, and expanded market reach. These findings confirm that payment gateways have become a primary need in the MSME business ecosystem. The decision to adopt them is not simply a trend, but a strategy to maintain competitiveness. This is also consistent with previous research that emphasizes the role of digitalization in improving MSME business efficiency.

Payment gateway implementation still faces several challenges. The dominant factor is unstable internet network disruptions, especially for MSMEs in areas with limited infrastructure. Some respondents also struggled to integrate the payment system with existing online sales applications. This situation requires adaptation and additional training for employees to master the new technology. Furthermore, delays in payment notifications often lead to misunderstandings with consumers. Administrative fees per transaction are also considered burdensome, especially for MSMEs with small order values. Another obstacle is consumers' limited ability to use QRIS due to unsupported devices. However, respondents stated that this problem can be overcome by providing alternative payment options. In general, the challenges faced are more technical than strategic. Therefore, payment gateways remain relevant and offer greater benefits than obstacles. This means that the system's benefits far outweigh the challenges.

The Influence of Payment Gateways on MSME Performance

The results of the path coefficient test show that payment gateways have a positive and significant effect on MSME performance [34]. Found that payment gateways significantly influence business development [35]. Found that digital payment adoption drives increased sales for MSMEs [36]. Found that the use of fintech improves transaction efficiency and small business performance [37]. Found that electronic payment systems expand online-based MSME market access. Found that digital payment integration increases customer satisfaction and loyalty to MSMEs.

The Effect of Green Financing on MSME Performance

The results of the path coefficient test show that green financing has a positive and significant effect on MSME performance [38]. Found that green finance significantly impacts MSME performance [39]. Found that environmentally friendly financing encourages cost efficiency and product innovation in MSMEs [40]. Found that access to

green financing increases the competitiveness of small businesses in the manufacturing sector [41]. Found that implementing sustainable financing strengthens the reputation and sustainability of MSMEs [42]. Found that green finance contributes to the growth of small businesses through environmentally friendly investments.

The Effect of Sustainability Innovation on MSME Performance

The results of the path coefficient test show that sustainability innovation has a positive and significant effect on MSME performance [43]. Found that sustainable innovation significantly impacts MSME performance [44].

Found that environmentally friendly innovation increases the added value of MSME products [45]. Found that implementing sustainable innovation strengthens competitiveness and customer loyalty [46]. Found that sustainability-oriented innovation reduces long-term costs and opens up opportunities for collaboration [47]. Found that sustainable innovation improves the business reputation and financial performance of small businesses.

Payment Gateways, Green Financing, and Sustainability Innovation simultaneously contribute to forming an integrated model for improving the performance of creative economy MSMEs

Qualitative findings indicate that creative economy MSMEs in Solo Raya view the integration of payment gateways, green financing, and sustainability innovation as a complementary synergy to improve business performance, transaction efficiency, support for environmentally friendly capital, and sustainable product differentiation [48]. Stated that payment gateways improve MSME business development [49]. Stated that green finance has a positive effect on MSME performance [50]. Stated that sustainability innovation significantly boosts MSME performance [51]. Stated that the adoption of digital payment systems expands the market and efficiency of MSMEs [52]. Stated that sustainable innovation strengthens the competitiveness and positive image of small businesses.

Obstacles and Perceptions Faced by MSMEs in Adopting Payment Gateway Technology

Interviews revealed that most MSMEs in Solo Raya consider the use of payment gateways essential for smooth transactions, market expansion, increased consumer trust, and a modern business image. Challenges include limited infrastructure, administrative costs, and low digital literacy [53]. Found that payment gateways significantly influence MSME business development [54]. Found that digital payment adoption increases sales and efficiency for small businesses [55]. Found that fintech supports smooth transactions and MSME performance [56]. Found that electronic payment systems expand MSME online market access [57]. Found that digital payment integration increases customer satisfaction and loyalty.

MSMEs' Experiences in Accessing Green Financing and Implementing Sustainable Business Practices

Field findings indicate that MSMEs' experiences in accessing green financing remain diverse. For those who succeed, this financing provides investment opportunities in environmentally friendly technologies and reduces operational costs, although the procedures are considered complicated. Those who have not yet accessed it face obstacles such as limited information, complex procedures, and minimal outreach. Awareness of implementing sustainable business practices continues to grow [58]. Found that green finance significantly impacts MSME performance [59]. Found that environmentally friendly financing encourages cost efficiency and innovation in MSMEs. Found that access to green financing increases the competitiveness of small businesses. Found that sustainable

financing strengthens the reputation of MSMEs [60]. Found that green finance supports the growth of environmentally-based small businesses.

MSME and Stakeholder Assessment of the Integrated Model Design

Interviews revealed that MSMEs and stakeholders considered an integrative model design combining payment gateways, green financing, and sustainability innovation relevant and feasible to implement to improve business competitiveness and sustainability [61]. These models are seen as complementary: payment gateways facilitate transactions, green financing supports environmentally friendly investments, and sustainability innovation encourages value-added product differentiation. Successful implementation requires policy support, mentoring, and literacy. Payment gateways improve MSME business development. Green finance has a significant effect on MSME performance. Sustainability innovation drives MSME performance and competitiveness. Digital system integration strengthens MSME efficiency and sales [62]. Sustainable innovation strengthens the positive image and sustainability of MSMEs.

CONCLUSION

Based on the results of this mixed-methods study, it can be concluded that payment gateways, green financing, and sustainability innovation have a positive and significant impact on the performance of creative economy MSMEs in the Solo Raya region, both partially and simultaneously, through a relevant integrative model. Payment gateways expand market access and improve transaction efficiency, green financing supports environmentally responsible investments, and sustainability innovation encourages the development of eco-friendly products and business processes. From the perspective of Islamic economics, these practices are consistent with the principles of justice (*adl*), social welfare (*maslahah*), and environmental stewardship (*khalifah*), which emphasize ethical financial transactions and responsible resource management. Overall, this integrative model was positively perceived by MSMEs and stakeholders, although its effectiveness requires continuous mentoring, supportive policies, and improved digital literacy among business actors. The implementation of these strategies also contributes to the broader agenda of achieving the United Nations Sustainable Development Goals (SDGs), particularly in promoting inclusive and sustainable economic growth. However, this study has several limitations. First, the scope of the research only covers MSMEs in the Solo Raya region, which may limit the generalizability of the findings to other regions. Second, the research focuses only on three main variables payment gateways, green financing, and sustainability innovation. Therefore, future studies are recommended to incorporate additional variables such as digital literacy, policy support, Islamic financial instruments, or global market access. Third, the cross-sectional research design captures only a single period of observation; thus, future research could employ longitudinal approaches to examine the long-term dynamics of MSME performance and sustainable development. Finally, the relatively limited number of respondents suggests the need for further studies involving larger and more diverse samples to obtain more comprehensive and representative results.

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Author Contribution

All authors jointly designed the study. Sisca Dian Rahmawati led conceptualization and analysis. Nur Rahmawati and Moenawar Kholil contributed methodology and interpretation. Qisthoni Permatasari and Mohammad Firdaus Mohammad Hatta supported data processing, visualization, and manuscript refinement and final review.

Conflicts of Interest

The author states that no conflicts occurred in the process of completing this research and the process of writing this article.

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