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## Article

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Article

# The Influence of E-Payment and E-Commerce Services on Supply Chain Performance: Implications of Open Innovation and Solutions for the Digitalization of Micro, Small, and Medium Enterprises (MSMEs) in Indonesia

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**Abstract:** The digitalization of micro, small, and medium enterprises (MSMEs) is important, considering the many associated benefits. Indonesia, through the government's direction, has begun to develop digitalization through the introduction of e-payment and e-commerce services into MSME supply chains, but many challenges are still encountered. In this research, we measured the influence of the use of e-payment and e-commerce services on MSME supply chain performance, as well as suggesting open innovations and solutions to accelerate the digitization of MSMEs. We collected data from 164 MSMEs in Indonesia, then conducted multiple linear regression analysis, descriptive analysis of research indicators, and interviews and discussions with research experts. The results demonstrate that there exists a positive and significant influence of both e-payment and e-commerce service variables on the performance of MSME supply chains in Indonesia. We determine ten research indicators with low values, which thus pose an obstacle to the digitization of MSMEs, and their implications, in order of open innovation and solutions, are presented in order to assist MSME actors, the government, and related institutions in accelerating the digitalization of MSMEs in Indonesia.

**Keywords:** digitalization solution; open innovation; e-payment services; e-commerce services; supply chain performance; micro small medium enterprises (MSMEs)



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## 1. Introduction

The rapid development of technology has encouraged the improvement of digitalization processes in various aspects and industries, including in micro, small, and medium enterprises (MSMEs) [1,2]. Digital MSME technologies are technological innovations introduced to improve the performance of business processes [3]. The digitalization of MSMEs requires the development of technologies that shift business processes and market conditions while reducing transaction costs. Digital MSME technologies are also multi-faced: e-commerce can help MSMEs to increase their customer and supplier base, while electronic invoice support can help to reinforce the integration of accounting systems [4]. The digital direction of MSMEs in Indonesia by the government—namely through increasing broadband access—aims to assist MSMEs in conducting e-commerce and to expand the usage of e-payments in MSMEs [5]. The roles of e-payments and e-commerce can help MSMEs to improve their business processes and enter the digital business ecosystem.

The use of e-payments in MSMEs is a supporting strategy tool that incorporates elements of marketing, sales, and customer service [6]. The adoption of e-payments in MSMEs plays an important role for consumers and merchants in terms of making payments and providing payment information [7]. An MSME e-payment system is a technology that helps businesses to compete with multi-national businesses without restrictions [8]. The

use of e-payments in MSMEs can also be defined as the use of a digital payment technology that provides various benefits, both in terms of improving the quality of transactions and accuracy [9]. The use of e-payments can provide many benefits for MSMEs, ranging from reducing costs [10], improving financial performance efficiency [10,11], increasing customer satisfaction, increasing the ability of MSMEs to compete globally, strengthening relationships with suppliers [12], and increasing sales, transparency, and security [8]. Furthermore, the use of e-payment services has made it easier for MSME players and customers to conduct transactions in the time of the COVID-19 pandemic [13] and reduce the spread of COVID-19 [14].

E-commerce in MSMEs is defined as the utilization of ICT and applications to support business activities through the translation of such activities from a manual to an electronic context [15]. E-commerce services in MSMEs involve platforms used to increase access to technology and to encourage innovation for entrepreneurs [16]. The adoption of e-commerce services in MSMEs can have a significant influence on their performance and provides new business models and directions through innovation [17]. In e-commerce services, the benefits obtained by MSMEs include improving business competence, higher labor efficiency, global transactions [18], offering customers a wider and more diverse range of products [19], business growth [20], and being able to manage sales transactions and material needs [21]. During the COVID-19 pandemic, MSMEs have had to change their business strategy towards e-commerce if they want to survive; therefore, digitalization is considered a solution for the survival of MSMEs [22,23].

The Indonesian government has designed the 30 Million MSMEs Go Digital in 2024 program to encourage the digitalization of MSMEs [24]; it is supported by the entry of e-payment and e-commerce services into the supply chain flow in order to improve the performance of the MSME supply chain in Indonesia [25]. Many previous studies have discussed the use of technology in MSMEs but have only focused on certain locations and only one of the services (i.e., e-payment services or e-commerce services) and have not considered their effect on the supply chain of MSMEs. For example, Denpasar and Palangkaraya have presented research discussing the use of e-payment services [26], while Jombang [27] and Denpasar [28] have conducted research on e-commerce services. It is important to statistically determine the significance of the influence of e-payment and e-commerce services on the performance of the MSME supply chain in order to support government directives and as the first step in accelerating the digitalization of MSMEs in Indonesia

The COVID-19 pandemic has had a serious impact on MSMEs, leading to a decrease in people's purchasing power due to physical distancing and the closure of businesses due to a lack of production [29]. The proportion of businesses that went bankrupt due to the pandemic was as high as 50% [30]. Switching to online business is considered the best solution for MSME players to survive the COVID-19 pandemic [31]. It is important to develop a marketplace and digital payment system for MSMEs to survive during the pandemic [32].

However, the implementation of digital MSMEs in Indonesia has not occurred optimally and MSMEs still face various problems related to demand, financing, and supply chains [33]. The involvement of digital payments in MSMEs is still relatively low as 51% of MSMEs do not make non-cash transactions [34,35] and it has been recorded that 75% of MSMEs are not sustainable enough to maintain their character and services when entering e-commerce [36]. The proportion of MSMEs included in the new digital ecosystem reached 23% of MSMEs in August 2021 [37]. Meanwhile, data regarding MSMEs that use online store technology focused on Java Island—namely DKI Jakarta at 40.5%, West Java at 21%, East Java at 7%, and Central Java at 6.5%—have indicated ample growth potential in this area [38]. It is necessary to determine the indicators linked with problems in implementing e-payment and e-commerce services in order to accelerate the digitization of MSMEs. MSMEs also need to take an open innovation viewpoint to develop their business

processes [39]. The adoption of open innovation is important to improve and accelerate the performance of MSMEs [40,41].

This study intends to fill the gaps in the literature regarding the use of e-payment and e-commerce services and their effect on the performance of the MSME supply chain in order to provide recommendations for acceleration of the digitalization of MSMEs in Indonesia through the following objectives:

1. Measure the influence and significance of the use of e-payment and e-commerce services on the performance of the MSME supply chain;
2. Identify the indicators of e-payment services, e-commerce services, and supply chain performance in MSMEs that have low values that may hinder the acceleration of MSME digitalization;
3. Suggest open innovation and solutions for MSMEs actors in order to increase the values of certain e-payment service, e-commerce service, and MSME supply chain performance indicators to accelerate the process of MSME digitalization.

In line with the research objectives above, the findings of this study significantly contribute to scientific and community knowledge. This research makes a key contribution to MSME players through the proposal of solutions to accelerate digital implementation and improve MSME performance through innovation and collaboration. The results of this study can help the government to design policy directions for the accelerated digitalization of MSMEs. The contribution of this study is also expected to help research institutions and related parties in developing collaboration with MSME actors. These findings provide insights to financial service providers and online stores in order to conduct innovative business development to reach a wider area. This research also contributes to the academic literature, allowing for further studies addressing similar issues. Finally, the results of this study provide insights and solutions to the community and employees in order to develop innovation and readiness for the digitalization of work and business.

## 2. Literature Reviews and Hypotheses

### 2.1. MSMEs in Indonesia

Micro, small, and medium enterprises (MSMEs) in Indonesia are businesses run by individuals or entities that are not branches of small, medium, and large businesses, which meet the criteria based on [42] (see Table 1). Based on data from the Ministry of Cooperatives and Small and Medium Enterprises in 2018, Indonesia had 64.19 million MSMEs, with a labor absorption of 117 million workers (or 97% of labor absorption). MSMEs contribute 61.07% of Indonesia’s total GDP, with a total non-oil and gas export contribution of 15.8% and an investment value contribution of 58.18% [43]. Criteria for Indonesian MSMEs:

**Table 1.** Criteria for Indonesian MSMEs.

Type of Enterprise	Asset Criteria (IDR)	Turnover Criteria (IDR)
Micro Enterprise	Maximum 50 Million	Maximum 300 Million
Small Enterprise	>50 Million–500 Million	>300 Million–2.5 Billion
Medium Enterprise	>500 Million–10 Billion	>2.5 Billion–50 Billion

Table 1 shows the criteria for MSMEs in Indonesia, where micro enterprises are businesses that have a maximum of IDR 50 million in assets with a turnover of IDR 300 million, small enterprises are businesses that have IDR 50–500 million in assets with a turnover of IDR 300 million to IDR 2.5 billion, while medium enterprises are businesses that have IDR 500 million to IDR 10 billion in assets with a turnover ranging from IDR 2.5–50 billion. The latest development of the MSME digitization process in Indonesia is the 30 Million Go-Digital MSME Players by 2024 program, with a target of six million MSME players entering the digital ecosystem every year. The government launched this digitalization program to encourage an increase in the competitiveness of MSMEs. The

number of MSMEs that have entered into the digital ecosystem is currently only 19% (or around 12 million) MSMEs [44].

### 2.2. Open Innovation in MSMEs

Open innovation is defined as the “use of purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation” [45]. Open innovation allows for: the formation of a strong network between companies and research and development facilities; the introduction of new ideas into organizations; interactions between start-up businesses, public research institutes, universities, and external suppliers; access to outside information and technology [46,47]. Open innovation has three dimensions: inbound, outbound [48], and coupling processes [49]. Inbound processes involve a company increasing its innovativeness by using, in addition to in-house R&D, external R&D provided by actors such as suppliers or customers. Outbound processes involve companies looking for external organizations that are better suited to commercializing their knowledge or technology. Coupling processes involve companies cooperating with other enterprises in strategic networks by coupling their outbound and inbound processes in order to integrate external knowledge and competencies while externalizing their own [50].

Open innovation has a key impact in terms of the technical performance of MSMEs and technological improvements in MSME business processes [51]. Open innovation can be adopted to develop the innovation capacity in MSMEs, helping them to improve their performance and achieve a sustainable competitive advantage [52]. Applying open innovation may speed up and enhance the innovation process of an organization and SMEs can benefit from open innovation as it inspires the growth of their knowledge base, rendering them more innovative [53]. Some characteristics of Indonesian SMEs match the implementation of open innovation; therefore, open innovation has been proposed as a methodology to address the problems of Indonesian SMEs [54]. Previous research has shown that SMEs tend to use open innovation particularly for commercialization rather than research and development [55]. Open innovation strategies in SMEs have positive effects in three innovation outcome dimensions: product, process, and marketing [56]. Adoption of open innovation may also indicate a favorable relationship between digital ecosystem readiness and open innovation adoption for SMEs [57].

In terms of open innovation for e-commerce, it has been shown [58] that the adoption of e-commerce through open innovation has a significant impact. Open innovation adoption also partially mediates the effects of organizational agility and absorptive capacity on innovation performance [53]. The concept of open innovation ensures that a business can provide better, faster, efficient, and cost-saving solutions to consumers [59]. A previous study [60] has shown that competitors, partners, universities, research institutions, suppliers, economic factors, and ecological issues are the most important external open innovation factors for MSMEs. Study [61] of the open innovation adoption of supply chains shows that suppliers, manufacturers, and customers find the benefits of open innovation. Another previous study has suggested there is an influence between external knowledge sourcing—as a means to implement inbound open innovation strategies—and performance ambidexterity [62].

### 2.3. Influence of E-Payment on MSME Performance

Electronic payment (or e-payment) is a mechanism used to transfer money electronically or digitally between two entities [63]; it can also be defined as the payment for goods or services on the internet through a bill-paying gateway [64]. Methods for e-payment include debit/credit cards, fund transfers, e-wallets, e-checks, wireless payments, e-banking, online banking, m-payment, e-broking, e-finance, payment gateways, and virtual currency [65–67]. The benefits of using electronic payments include time savings, reduced risk of losing money, low transaction costs, high security, data accuracy, improved process efficiency, and increased sales [68].

The e-payment service is also known as a cashless payment system, with financial transactions executed online between buyers and sellers [69]. Based on the research by Sopian and Ismail [70] the use of cashless transactions has an impact on the performance of the payment system by enhancing the digital payment rate and increasing economic growth. The results of Hutapea's research on financial technology demonstrated that, by implementing a financial technology information system, business actors can obtain positive benefits for their business progress and customer satisfaction [71]. Through research findings, Owuso and Jaja [72] have shown that there exists a strong relationship between e-payment services and supply chain performance, especially in terms of the factors of delivery reliability and lead time in companies.

Xena and Rahadi have shown that the adoption of e-payment services supports the SMEs payment system, which can be influenced by user trust, culture, technological acceptance, security, environment, and social influence [73]. Studies conducted by Kwabena et al., [12] have also shown that the use of a digital payment system has a significant effect on SME performances in developing countries. The use of a digital payment system enables SMEs operating in various countries to compete globally, satisfy customers, and strengthen their relationships with partners and government. The findings of a study by Prihatiningtias and Wipraganang [74] showed that the use of mobile payments can improve the performance of SMEs in non-financial areas and can help businesses to survive during pandemics. The research on the adoption of the use of e-payments by Mohd Yusof et al., [75] has revealed that e-payment services can help SMEs to increase their business and benefit customers. Isaac and Ogundipe have concluded that the adoption of the use of mobile money to allow a different transaction mode for customers significantly affected the performance of selected family enterprises (i.e., micro enterprises) during the COVID-19 lockdowns [76]. Therefore, we propose the first hypothesis of this study as follows:

**Hypothesis 1 (H1).** *The use of e-payment services has a statistically significant positive influence on supply chain performance of MSMEs in Indonesia.*

#### *2.4. Influence of E-Commerce on MSME Performance*

Electronic commerce (e-commerce) can be defined as the occurrence of transactions or exchanges of information between sellers in the virtual world. The emergence of e-commerce is inseparable from the rapid development of information technology, especially the internet. E-commerce allows companies to reach all over the world in order to market their products or services without being limited by geographical boundaries [77]. Electronic commerce involves financial transactions carried out through the internet or personal communication networks, in which the purchase and sale of goods and services, as well as money transfers, may take place. An electronic commerce transaction can be a simple confirmation of the wishes and possibilities of purchases with a credit card, where the transfer of the required amount from one account to another is conducted afterward. E-commerce is any form of business relationship where the interaction between actors occurs through the use of internet technology [78]. The benefits of electronic commerce are: facilitating 24/7 shopping, convenience, time saving, no geographical limitation, increased efficiency, precise target marketing, and ease of initiating and administrating a company [79].

According to the research of Andonov et al., [80], which focused on identifying and assessing how e-commerce impacts the performance of an organization, firms are able to significantly augment their performance level due to the increased marketplace, better growth opportunities, lower operating costs, lower requirement for investment, less risks, and more. The empirical study of Priambodo et al., [8] has shown that creative firm e-commerce performance was significantly influenced through the indirect relationship between e-commerce capabilities and innovation capabilities, while the direct relationship between e-commerce capabilities toward creative firm e-commerce performance was

insignificant. This result indicates that innovation capabilities play an essential role in enhancing e-commerce capabilities.

A study of e-commerce application in SMEs by Siti Syuhada et al., [15] has revealed that the customer, technology, competition, and supplier factors all have a strong relationship with the application of e-commerce among SME entrepreneurs. The research by Islam et al., [81] on the adoption of e-commerce by SMEs showed that fully functional applications of e-commerce can help SMEs to reduce costs, enhance operational efficiency, provide better customer service, and conduct better inventory management and market expansion. The study focusing on the influence of SMEs in the adoption of e-commerce by Perumal et al., [82] has shown that there is a significant influence of the relationship between the technological context and the adoption of e-commerce in SMEs, while there was no significant relationship between the organizational context and the adoption of e-commerce in SMEs. The results of the study by Riadi et al., [83] on the adoption of e-commerce services in small enterprises indicated that there were significant differences in the benefits of e-commerce before and during the COVID-19 pandemic (e.g., reduced promotion cost, improved speed of processing, reduced complaints), and also demonstrated the need for connectivity and internet access support. Lukiyana and Yusuf [84] have shown that e-commerce has an influence on MSME marketing performance, as e-commerce had a positive and significant impact on the marketing performance of MSMEs. Yu et al., [85] have shown that the supply chain of e-commerce platforms based on IoT technology suffers less loss risk. The application and expansion of this technology is expected to effectively lower the market risk of supply chain finance and to better serve economic development. Thus, we propose the second hypothesis in this study as follows:

**Hypothesis 2 (H2).** *The use of e-commerce services has a statistically significant positive influence on supply chain performance of MSMEs in Indonesia.*

### 2.5. Operationalizing the Study Variables

E-payment services: the use of e-payment services in MSMEs can be seen as the use and development of a payment system technology that provides many business performance benefits [9,86]. In this study, we focus on retail electronic payments, including transactions made through payment cards (e.g., credit, debit), fee/pre-paid (stored value) cards, mobile payments (card- and network-based), electronic fund transfers (direct debit and credit transfer), and virtual money or accounts, as studied previously [87]. In this study, e-payment services in MSMEs are measured to determine the understanding of business actors regarding the use of e-payment services, how e-payment services are applied in business processes, the advantages of e-payment services, the ability of employees and third parties in the implementation of e-payment services in business processes, and the provision of training in the context of adopting the use of e-payment services. This study also investigates whether MSMEs have sufficient resources, facilities, and technological infrastructure to apply e-payments, as well as organizational commitment and support for the use of e-payment services to improve MSME business performance. The indicators used for the e-payment service variables are awareness, human resources, business resources, technology resources, commitment, and governance, as adopted from previous research [7,74,88].

- E-commerce services: studies have shown [15,16] that e-commerce in MSMEs can be present in the form of applications or platforms that transition the performance of MSMEs from manual to electronic means. In this study, the e-commerce services used by MSMEs are in the form of such applications or platforms owned by the company itself or those owned by online trading service providers to help business processes and facilitate business actors, suppliers, and customers. In this study, we measure the use of e-commerce services in MSMEs to determine the e-commerce implementation process in MSME business processes, as well as the benefits that can be gained related to cost reduction, the speed and effectiveness of the marketplace performance

process, improving communications, and other support. Therefore, the indicators used in this study, adopted from [23,87,89] are success of development, cost saving, communication improvement, marketplace performance, and overall satisfaction.

- Supply chain performance: the supply chain consists of all parties involved—both directly and indirectly—in meeting customer demands [90]. Performance indicators in the supply chain are measured to obtain valuable information used in decision making. The determination of performance indicators to obtain effective and important improvements is a difficult task for supply chain actors [91]. The supply chain performance variables in this study involved measuring the relationships between suppliers and business actors, the ability to plan and develop products, the ability to find new opportunities and markets, the effectiveness of business processes involving third parties and customers, and the ability to carry out supply chain flow activities appropriately. Thus, the indicators used in this variable were agility, adaptability, alignment, long-term relationship, information sharing, and process integration, as adopted from previous research [92,93].

Depending on the reviewed literature, the following research variable relationship framework was developed as shown in the following Figure 1.

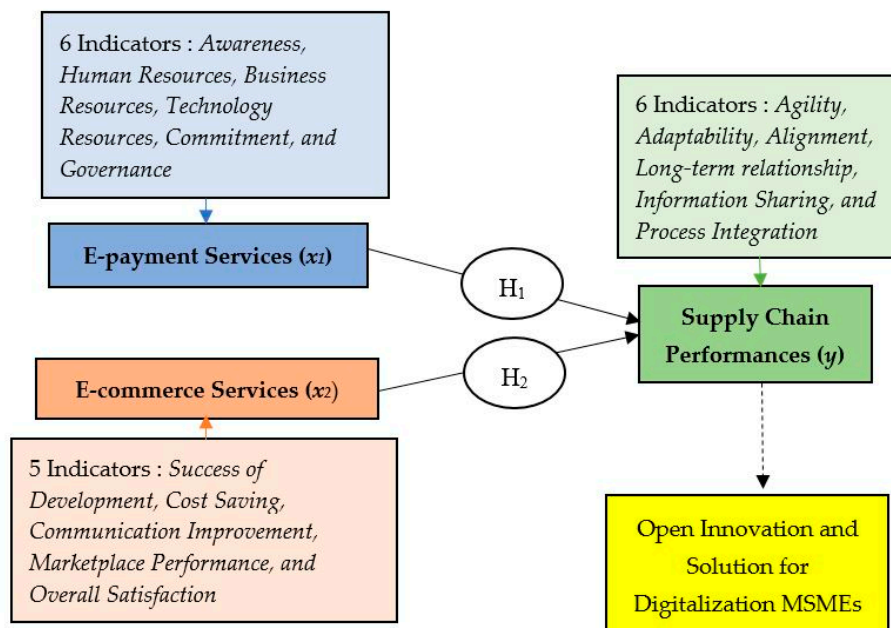


Figure 1. Research Variable Relationship Framework.

### 3. Research Methods

#### 3.1. Population and Sample

The population used in this study was MSMEs in Indonesia in the period 2020–2022. The sampling technique used was a probability sampling technique using cluster sampling based on a pre-determined population area [94]. Based on the background of the research [38], as the digitization of MSMEs is still limited in regions in Java, the samples in this study were taken from areas both in and outside of Java Island, namely Jakarta, Surabaya, Padang, Pontianak, Manado, Makassar, and Ambon.

The population in this study was broad enough that it satisfied the required number of samples calculated based on the various theories of sample size. According to the theory of Roscoe (1975), the sample size should be at least 10 times the number of considered factors; meanwhile, Malhotra’s theory (1993) states that the sample size should be at least 5 times the number of research indicators [95]. Furthermore, another theory for determining the sample size [96] and [97] states that the sample should amount to at least 5 times the



number of research indicators and at most 10 times the number of research indicators, presented mathematically as follows:

$$\text{Minimum sample size} = \text{Number of Indicators} \times 5$$

$$\text{Maximum sample size} = \text{Number of Indicators} \times 10$$

The samples obtained in this study amounted to 164 MSMEs. Therefore, considering a total of 17 research indicators, the minimum number of samples needed in this study was  $5 \times 17 = 85$  MSMEs and the maximum number of samples was  $10 \times 17 = 170$  MSMEs. Thus, the number of samples used in this study was appropriate.

### 3.2. Source of Data and Data Collection Instruments

The methods used in this study are quantitative methods, including data collection through previous research literature studies and supporting backgrounds, as well as data collection using instruments in the form of questionnaires. The questionnaire used in this study consisted of four parts: Part 1 involved business information, Part 2 involved e-payment services, Part 3 involved e-commerce services, and Part 4 involved supply chain performance. The questionnaire was formulated using a Likert Scale.

The distribution of questionnaires was carried out online by email and social media using Google Forms. The distribution of questionnaires was carried out for five months from December 2021 to April 2022.

### 3.3. Validity and Reliability Test

The research instruments, with a total number of 60 statement items, were tested through validity and reliability tests. The validity test was performed through analysis of the correlation between the score on each statement item and the total score. The instrument was declared valid if the value  $r$  calculated is greater than that in the relevant table [98,99]. The equation for conducting validity tests using the Pearson product moment is as follows:

$$r_{xy} = \frac{n \sum X_i Y_i - \sum X_i \sum Y_i}{\sqrt{n \sum X_i^2 - (\sum X_i)^2} \sqrt{n \sum Y_i^2 - (\sum Y_i)^2}} \tag{1}$$

where  $r_{xy}$  is the correlation coefficient between variables  $X$  and  $Y$ ,  $X_i$  is the value of data point  $i$  in variable group  $X$ ,  $Y_i$  is the value of data point  $i$  in variable group  $Y$ , and  $n$  is the number of data points. Furthermore, validity testing refers to the significance level of confidence (confidence level = 95%) of 5% (or 0.05), with the following formula:

$$t = \frac{r_i \sqrt{(n-2)}}{\sqrt{1-r_i^2}}; db = n - 2 \tag{2}$$

Based on the test results for the 3 research variables and 17 indicators, the research instrument was confirmed to be valid, with a value of  $r$  for all indicators higher than that in the table (0.361), as shown in Table 2, Validity Test Results.

After testing the validity of each variable and research indicator, which confirmed that all research instruments were valid, a reliability test was conducted for each research variable. A reliability test is used to determine the consistency of the research instrument with reliable data calculations, again comparing the value of  $r$  against the table [100]. The formula that can be used to calculate reliability is as follows:

$$r_{11} = \left[ \frac{k}{k-1} \right] \left[ 1 - \frac{\sum \sigma_b^2}{\sigma_f^2} \right] \tag{3}$$

where  $r_{11}$  is the coefficient of the reliability instrument,  $k$  is the number of valid question items,  $\sum \sigma_b^2$  is the sum of item variances, and  $\sigma_f^2$  is total score variance. The reliability test

results for each research variable against the *r* table value (0.361) indicated a high reliability level ( $0.70 < r_{11} \leq 0.90$ ), according to [101], as can be seen in Table 3, Reliability Test Results.

**Table 2.** Validity Test Results.

Indicator	R Count	Description
Awareness	0.435	Valid
Human Resources	0.523	Valid
Business Resources	0.509	Valid
Technology Resources	0.464	Valid
Commitment	0.680	Valid
Governance	0.621	Valid
Success of Development	0.546	Valid
Cost Saving	0.562	Valid
Communication Improvement	0.781	Valid
Marketplace Performance	0.633	Valid
Overall Satisfaction	0.582	Valid
Agility	0.603	Valid
Adaptability	0.539	Valid
Alignment	0.579	Valid
Long-Term Relationship	0.569	Valid
Information Sharing	0.463	Valid
Process Integration	0.445	Valid

**Table 3.** Reliability Test Results.

Variable	Cronbach’s Alpha	Description
E-payment Services	0.875	Reliable
E-commerce Services	0.881	Reliable
Supply Chain Performance	0.879	Reliable

*3.4. Method of Data Analysis*

We used a data analysis method adopted from previous research [102] to determine the relationship between research variables and test hypotheses using multiple linear regression analysis. In previous studies, the method used only measured the influence between variables as the findings of [26–28]. Several previous studies also show that the measurement of e-payment and e-commerce uses a method to measure the influence between variables [8,12,15,73], while in this study it was developed to provide solutions to accelerate the digitalization of MSMEs.

In this study, we used three data analysis methods for each problem formulation: The first was multiple linear regression analysis, which was used to measure the effect of the use of e-payment and e-commerce services on the MSME supply chain performance. The second method was a descriptive analysis of research indicators, which was used to determine the value of each research indicator, thus revealing which provided high and low contributions. For the third problem, we used the method of interviews and discussions with experts in order to develop open innovations and solutions to business actors, governments, institutions, and the public to accelerate the digitization of MSMEs in Indonesia. This interview and discussion method was adapted from [103,104] and was conducted with three experts in the fields of e-payment and e-commerce, MSMEs, and supply chains.

**4. Discussion and Analysis**

*4.1. Respondent Characteristics*

The characteristics of respondents in this study were obtained through Part 1 of the research questionnaire, which was filled out by 164 respondents spread across seven cities in Indonesia, namely Jakarta, Surabaya, Makassar, Padang, Manado, Pontianak, and Ambon.

The characteristics of the samples in this study consisted of location, type of MSMEs, use of e-payment services, and use of e-commerce services, which are further described in Table 4, Respondent Characteristics.

**Table 4.** Respondent Characteristics.

Items	Category	Frequency (n = 164)	Proportion (%)
Location of MSMEs	DKI Jakarta	31	18.90%
	Surabaya	27	16.46%
	Makassar	23	14.02%
	Padang	24	14.63%
	Manado	20	12.20%
	Pontianak	21	12.80%
	Ambon	18	10.98%
Type of MSMEs Industry	processed food	33	20.12%
	handicrafts	41	25.00%
	furniture	25	15.24%
	fashion	20	12.20%
	electronics	8	4.88%
	F&B	37	22.56%
Use of e-payment services	e-payment is available and actively used	50	30.49%
	e-payment is available and rarely used	63	38.41%
	e-payment is not available at MSMEs	51	31.10%
Use of e-commerce services	MSMEs already use e-commerce services	66	40.24%
	MSMEs did not use e-commerce services	98	59.76%

The sample distributions by location had the following values: Jakarta (18.9%), Surabaya (16.46%), Makassar (14.02%), Padang (14.63), Manado (12.2%), Pontianak (12.8%), and Ambon (10.98%). Meanwhile, the types of MSMEs in this study sample consisted of MSMEs that make handicrafts (25%), F&B (22.56%), processed food (20.12%), furniture (15.24%), fashion industry (12.2%), and electronics (4.88%). The e-payment services category presents data on the MSMEs that provide and actively use e-payments (only 30.49%), MSMEs that provide but rarely use e-payments (38.41%), and MSMEs that do not provide e-payment services (31.10%). In the e-commerce services category, it can be seen that 40.24% of MSMEs already used e-commerce services, while 59.76% of MSMEs did not use e-commerce services.

*4.2. Descriptive Statistical Analysis*

Descriptive statistical analysis was conducted to measure the mean of the survey results of each research indicator, which must be higher than the standard deviation; see Table 5, Result of Descriptive Statistical Analysis.

Based on the results of the descriptive statistical analysis of the 17 research indicators shown in Table 5, the minimum indicator value was 2.00 and the maximum indicator value was 31.00, which was influenced by the number of sub-indicators in each research indicator. Meanwhile, the standard deviation of all research indicators was smaller than the mean value (average) for each research indicator, meaning that the distribution of data in this study was small or there was not a large data gap, such that the data used in this study can be considered to be good data.

**Table 5.** Result of Descriptive Statistical Analysis.

Indicator (n = 164)	Min	Max	Mean	Percentage (%)	Std. Dev.
Awareness	4	20	15.55	77.77	2.61
Human Resources	4	20	9.23	46.16	3.29
Business Resources	7	23	14.60	58.41	4.10
Technology Resources	3	15	6.08	40.53	2.55
Commitment	3	15	11.65	77.68	2.09
Governance	3	15	6.82	45.49	2.60
Success of Development	5	20	10.93	54.66	3.39
Cost Saving	3	15	7.57	50.45	3.01
Communication Improvement	2	10	8.48	84.76	1.58
Marketplace Performance	3	14	8.65	57.64	2.59
Overall Satisfaction	5	20	12.92	64.60	3.64
Agility	5	20	14.80	73.99	3.26
Adaptability	7	23	12.99	51.98	3.68
Alignment	13	31	20.47	58.48	5.15
Long-Term Relationship	2	10	8.32	83.17	1.85
Information Sharing	2	10	8.26	82.56	1.68
Process Integration	2	10	3.85	38.48	1.87

4.3. Classic Assumption Test

The classical assumption test used in this study is a statistical requirement that must be met for multiple linear regression analysis, carried out in terms of a normality test, a multicollinearity test, and a heteroscedasticity test.

4.3.1. Normality Test

The normality test aims to test whether the residual values are generated by a normal distribution regression or not, which can be determined through analysis using graphs and statistical tests [105]. A normality test was carried out to test whether the regression model on the independent variables of e-payment services ( $x_1$ ) and e-commerce services ( $x_2$ ) as well as the dependent variable of supply chain performance ( $y$ ) presented a normal or non-normal distribution. This statistical test is said to indicate a normal distribution if the significance level is greater than 0.05. Research using the Exact method can obtain accurate results [106]. The data are distributed normally in the normal regression standardized residual PP plot when the data are spread between the diagonal lines and follow the direction of the line [107]. The results of the normality test are shown in Table 6, Normality Test Results.

**Table 6.** Normality Test Results.

	Unstandardized Residual
N	164
Exact Sig. (2-tailed)	0.214

The normality test result was 0.214, which was more than 0.05, while the results obtained with the graph method showed that the data were distributed between the diagonal lines and followed the direction of the lines on the graph (see Figure 2). Therefore, it can be stated that the data in this study were normally distributed.

4.3.2. Multicollinearity Test

Multicollinearity tests are performed to look at the linear relationships between independent variables, because a high correlation between independent variances can make it difficult to distinguish each influence of variable on the dependent variable [107]. A multicollinearity test in this study was carried out to determine the correlations between the independent variables (e-payment services and e-commerce services) or dependent variables (MSME supply chain performance). Data that have a VIF result greater than 10 ( $VIF > 10$ ) and a tolerance value less than 0.01 ( $Tolerance < 0.01$ ) symptoms of multi-

collinearity [108]. The results of the multicollinearity test are shown in Table 7, Result of Multicollinearity Test.

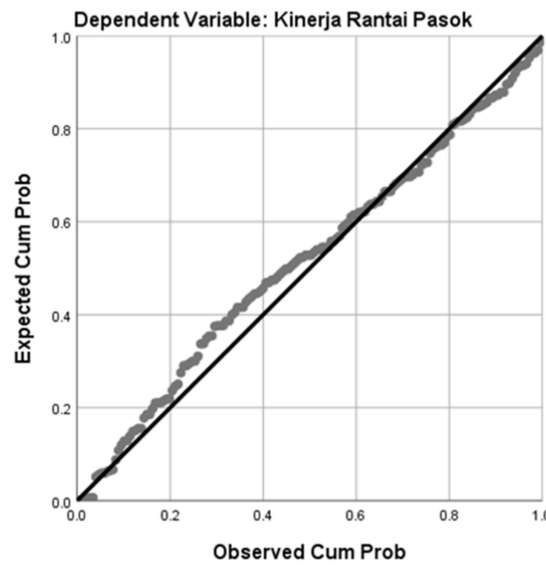


Figure 2. Normal PP Plot of Regression Standardized Residual.

Table 7. Result of Multicollinearity Test.

Variable	Collinearity Statistics	
	Tolerance	VIF
E-payment Services	0.214	4.675
E-commerce Services	0.214	4.675

Dependent Variable: Supply Chain Performance.

Based on the multicollinearity test using the SPSS 25 software (SPSS Inc., Chicago, IL, USA) (see Table 7), the VIF value was 4.675 and the tolerance value was 0.214, so it can be concluded that the data in this study did not present multicollinearity.

#### 4.3.3. Heteroscedasticity Test

A heteroscedasticity test aims to determine whether there is an inequality in variance between the residual of one observation and another in the regression model. In this paper, the heteroscedasticity test was carried out using the Glejser method, where test results with significance values over 0.05 (Sig > 0.05) indicate that the variables do not present heteroscedasticity [108].

The results obtained are shown in Table 8, which shows the significance value of the e-payment service variable was 0.435, while that of the e-commerce service variable was 0.431, meaning that the two variables did not present heteroscedasticity with respect to the dependent variable.

Table 8. Result of Heteroscedasticity Test.

Model	T	Sig
E-payment Services	0.783	0.435
E-commerce Services	0.789	0.431

Dependent Variable: Supply Chain Performance.

#### 4.4. Multiple Linear Regression Analysis

Multiple linear regression analysis was carried out to analyze the relationships between the two independent variables (e-payment services and e-commerce services) and the

dependent variable (MSME supply chain performance). This analysis can also be used to determine the magnitude of influence exerted in the relationships between these variables in order to verify the research hypotheses. The mathematical equation used for the multiple linear regression analysis in this study is formulated as follows:

$$Y = a + b_1 x_1 + b_2 x_2 + \dots + b_n x_n$$

where  $Y$  is the independent variable (the value of the variable to be predicted),  $a$  is a constant term,  $b_1, b_2, \dots, b_n$  are regression coefficients, and  $x_1, x_2, \dots, x_n$  are the free variable values.

#### 4.4.1. The Influence of E-Payment Services ( $x_1$ ) and E-Commerce Services ( $x_2$ ) on the Performance of the MSME Supply Chain ( $y$ )

Measurements to determine the effect of the use of e-payment services ( $x_1$ ) and e-commerce services ( $x_2$ ) on supply chain performance ( $y$ ) in order to support the digitization of MSMEs in Indonesia were carried out through multiple linear regression tests using the SPSS 25 software (SPSS Inc., Chicago, IL, USA) with the regression analysis summary model presented in Table 9, Model Summary:

Table 9. Model Summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.868	0.754	0.750	6.12388

Predictors: (constant), e-commerce services, e-payment services.

Based on the summary model, a correlation coefficient (R) of 0.868 and a regression coefficient (R square) of 0.754 were obtained. The value of the correlation coefficient (R) can be interpreted to mean that there existed strong relationships between the use of e-payment services and e-commerce services with the MSME supply chain performance according to [95]. Furthermore, the regression coefficient value (R square) can be interpreted as indicating that the use of e-payment and e-commerce services had a significantly positive influence on supply chain performance to support the digitization of MSMEs in Indonesia.

#### 4.4.2. Hypothesis Test

Hypothesis testing was carried out to determine the effect of the use of e-payment services ( $x_1$ ) and e-commerce services ( $x_2$ ) on the MSME supply chain performance ( $y$ ), which was simultaneously carried out through F-test and partial testing through T-tests.

##### Simultaneous Hypothesis Test (F-Test)

Simultaneous hypothesis testing was carried out using the statistical F-test, in order to measure the effect of the use of e-payment services ( $x_1$ ) and e-commerce services ( $x_2$ ) on the performance of the MSME supply chain ( $y$ ), with the results shown in Table 10, ANOVA:

Table 10. ANOVA.

Model		Sub of Squares	Df	Mean Square	F	Sig.
1	Regression	18,457.710	2	9228.855	246.091	0.000
	Residual	6037.802	161	37.502		
	Total	24,495.512	163			

Dependent variable: supply chain performance. Predictors: (constant), e-commerce services, e-payment services.

The basic decision-making criteria of the statistical F-test (or ANOVA) are as follows: If  $F_{\text{calculated}} > F_{\text{table}}$  (sig. > 0.05), then hypothesis is accepted (there exists an influence); if  $F_{\text{calculated}} < F_{\text{table}}$  (sig. < 0.05), then the hypothesis is rejected (there is no influence).

The results of the data in Table 10, ANOVA, show that the significance value (Sig.) was 0.000, lower than 0.05. Therefore, the hypothesis was accepted. Furthermore, based on the results of the F-test, an F-value of 246.091 was obtained. Compared with the table

F-value of 3,052, it can be said that the hypothesis was accepted; in other words, based on statistical testing, there is a significantly positive influence of the use of e-payment services ( $x_1$ ) and e-commerce services ( $x_2$ ) on supply chain performance ( $y$ ), thus supporting the digitization of MSMEs in Indonesia.

Partial Hypothesis Test (T-Test)

We also measured the individual effects of the use of e-payment services ( $x_1$ ) and e-commerce services ( $x_1$ ) on the MSME supply chain performance ( $y$ ) by partial hypothesis testing through the statistical T-test, which utilizes the coefficient table from multiple linear regression analysis using the SPSS 25 software (SPSS Inc., Chicago, IL, USA). The results are shown in Table 11, Coefficients:

Table 11. Coefficients.

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	21.723	2.388		9.097	0.000
	E-payment Services	0.183	0.079	0.196	2.317	0.022
	E-commerce Service	0.726	0.089	0.689	8.150	0.000

Dependent Variable: Supply Chain Performance.

The coefficients in Table 11 show that the results for the variable e-payment service were T-value = 2.317 and Sig. = 0.022. Meanwhile, for the e-commerce service variable, we obtained T-value = 8.150 and Sig value. = 0.000. The basic criteria for making statistical test decisions based on the T-value when measuring the influence of independent variables on dependent variables are as follows: If  $t_{calculated} > t_{table}$  (Sig. < 0.05), then the hypothesis is accepted (influential); if  $t_{calculated} < t_{table}$  (Sig. > 0.05), then the hypothesis is rejected (has no effect).

Based on the basic criteria of the statistical *t*-test, as the calculated T-value (2.317) of e-payment services was greater than the table value (1.975) and the significance value (0.022) was less than 0.05, it can be stated that Hypothesis 1 could be accepted; or, statistically interpreted, there exists a positive significant influence of e-payment services on supply chain performance. Meanwhile, the results of hypothesis testing for the effect of e-commerce services on the performance of the MSME supply chain gave a calculated T-value of 8.150 (greater than the table T-value of 1.975) and a significance value of 0.000, such that it can be stated that Hypothesis 2 could also be accepted; in other words, it can be said that e-commerce services have a positive significant influence on supply chain performance to support the digitization of MSMEs.

**Hypothesis 1.** *The use of e-payment services has a statistically significant positive influence on supply chain performance of MSMEs in Indonesia.*

Hypothesis 1 was based on a calculated F-value of 246.091, greater than the table F-value of 3052, and the calculated T-value of the e-payment service variable (2.317) was greater than the table T-value (1.975) with a significance value of less than 0.05. This result is supported by Kwabena’s research in Ghana, who stated that the use of e-payment services has a significant influence on supply chain performance in developing countries, as well as Isaac and Ogundipe’s study in Nigeria, who found that mobile money affected the performance of MSMEs during COVID-19 lockdowns.

**Hypothesis 2.** *The use of e-commerce services has a statistically significant positive influence on supply chain performance of MSMEs in Indonesia.*

Hypothesis 2 is based on a calculated F-value of 246.091, greater than the table F-value of 3052, and the calculated T-value of the e-commerce service variable (8.150) being greater than the table T-value (1.975) with a significance value of less than 0.05. This result is in line with the research of Islam et al., in Bangladesh, who showed that adoption of the use of e-commerce services has a positive effect and provides benefits for the performance of MSMEs, as well as Perumal's research in China, who found that the influence of e-commerce on the performance of MSMEs can reduce market risks and promote economic development.

#### 4.4.3. Regression Equation

The direction of the effect of the use of e-payment services ( $x_1$ ) and e-commerce services ( $x_2$ ) on the MSME supply chain performance ( $y$ ) can be determined using the regression equation. Based on the results of the multiple linear regression analysis detailed above, the regression model in this study can be described mathematically as follows:

$$Y = a + b_1 x_1 + b_2 x_2 + \dots + b_n x_n$$

$$\text{Supply Chain Performances} = 2.723 + 0.183 (\text{e-payment services}) + 0.726 (\text{e-commerce services})$$

From the regression model in the equation above, several conclusions can be drawn, as follows:

- The constant value (a) of 21,723 indicates that if the independent variables of e-payment services ( $x_1$ ) and e-commerce services ( $x_2$ ) are zero, then the value of the dependent variable of MSME supply chain performance ( $y$ ) is 21.723.
- The regression coefficient of the e-payment service variable ( $x_1$ ), which is positively valued, indicates that if e-payment services ( $x_1$ ) increase by 1 (one) point, then the MSME supply chain performance ( $y$ ) will increase by 0.183 (or 18.3%). This can be interpreted to mean that e-commerce services contribute positively, by 18.3%, to supply chain performance in improving the digitalization process of MSMEs in Indonesia.
- The positive value of the regression coefficient for the e-commerce services variable ( $x_2$ ) indicates that if e-commerce services ( $x_2$ ) increase by 1 (one) point, then the MSME supply chain performance ( $y$ ) will increase by 0.726 (or 72.6%). Thus, it can be said that e-commerce services have a high contribution to the performance of the supply chain, thus strongly accelerating the implementation of digital MSMEs in Indonesia.

#### 4.5. Analysis of Research Indicators

Descriptive analysis of each research indicator was carried out to determine indicators with high and low values in terms of affecting the process of digitizing MSMEs, based on the results of questionnaires filled out by the 164 respondents in this study. The results of indicators with high and low values will serve as the basis for the formulation of open innovations and solutions for MSME actors in order to accelerate digitalization and improve MSME performance. The results of the comprehensive descriptive analysis of research indicators are given in Table 12.

Based on the comprehensive descriptive analysis of the research indicators, the indicators with very high, high, low, and very low values were obtained, as determined through the calculation of the percentage of each indicator and categorized using continuum lines [109].

Research indicators in the very high category were communication improvement (84.76%), long-term relationship (83.17%), and information sharing (82.56%). Meanwhile, indicators in the high category were awareness (77.77%), commitment (77.68%), agility (73.99%), and overall satisfaction (64.60%). The results of the analysis showing these seven indicators as having high values can be interpreted as the fact that MSMEs have already gained an awareness of the importance of using e-payment and e-commerce services to improve the supply chain performance of MSMEs, and that MSMEs experience benefits in terms of improved communication, information sharing with third parties and customers,



among other benefits, such that MSME actors are ready to show commitment in the context of implementing the use of e-payment and e-commerce services in business processes.

**Table 12.** Result of descriptive analysis of research indicators.

Indicator	N	Percentage	Category
Awareness	164	77.77%	High
Human Resources	164	46.16%	Low
Business Resources	164	58.41%	Low
Technology Resources	164	40.53%	Low
Commitment	164	77.68%	High
Governance	164	45.49%	Low
Success of Development	164	54.66%	Low
Cost Saving	164	50.45%	Low
Communication Improvement	164	84.76%	Very High
Marketplace Performance	164	57.64%	Low
Overall Satisfaction	164	64.60%	High
Agility	164	73.99%	High
Adaptability	164	51.98%	Low
Alignment	164	58.48%	Low
Long-Term Relationship	164	83.17%	Very High
Information Sharing	164	82.56%	Very High
Process Integration	164	38.48%	Very Low

Research indicators in the low and very low categories were alignment (58.48%), business resources (58.41%), marketplace performance (57.64%), success of development (54.66%), adaptability (51.98%), cost saving (50.45%), human resources (46.16%), governance (45.49%), technology resources (40.53%), and process integration (38.48%). The indicators with low values in this study need to be improved through follow-up steps, as there are still many MSMEs that have not entered the digital ecosystem: in [37], data revealed that only 23% of MSMEs in Indonesia had entered the digital ecosystem, while [38] showed that MSMEs who use online stores are still focused on Java Island. This was supported by a study [110] that stated that the digital maturity level of Indonesian MSMEs is still ranked 13th out of 14 countries in Pacific Asia, while those also at the first level include Vietnam, Thailand, the Philippines, and Malaysia. There needs to be implications for open innovation and solutions in order to increase the values of these indicators and accelerate digitalization in Indonesia and even in other developing countries.

*4.6. Implications of Open Innovation and Solutions*

The implications of open innovation and solutions to be provided to MSMEs, governments, institutions, third parties, customers, and the public were determined through consultation with experts in the fields of e-payment and e-commerce, MSMEs, and supply chains.

The measurement results obtained for each independent variable had a significantly positive influence on the dependent variable in this study. Descriptive analysis of the research indicators indicated that there were 10 low-value research indicators, as detailed above, such that it is necessary to formulate open innovations and solutions to be implemented by MSME actors, governments, related institutions, and even third parties and the public. These were constructed through interviews and discussions with research experts in the fields of e-payments and e-commerce, MSEs and MSMEs, and supply chains. The results of the interviews and discussions with research experts are provided in the following, in terms of the formulation of implications of open innovation and solutions for accelerating the digitization of MSMEs in Indonesia.

#### 4.6.1. Expert in E-Payment and E-Commerce Services

*Human Resources.* The problem that occurs in this indicator is the ability of employees to adapt to business processes related to the use of applications and the lack of training initiatives to increase employee willingness in the adoption of e-payment services. First, this is due to a lack of education level in most MSME actors. Second, there is a lack of digital literacy in some MSME actors who are not millennials. Third, there is a reluctance to use new technologies as the actors are already comfortable with conventional non-digital methods. The inability to adapt to e-payment technology is also due to the socialization and training required to learn how to use it. For this reason, the strategies and solutions that need to be carried out in MSMEs involve improving digital literacy as well as providing training and assistance on how to use e-payments. Furthermore, it is necessary to show concretely the benefits or value of using e-payments in MSMEs. The expert experience regarding MSMEs shifting to a digital base was that some MSMEs actors still see digitalization as something abstract and not part of usual business.

*Technological Resources.* It may be that an MSME's technological infrastructure is insufficient to facilitate e-payment services as the digital gap in Indonesia is still large, although efforts to equalize digital infrastructure continue to be carried out by the government and the private sector. The main requirement of e-payment services is an accessible and stable data communication network connection. If there are obstacles at the time of making a transaction, then MSMEs will be reluctant to use e-payment. For this reason, the strategies and solutions are that MSMEs should utilize a mobile infrastructure that has a wider range, and trials may be conducted to adjust to the ability of mobile network providers located in the area.

*Governance.* One problem that occurs is the inability to analyze changes in organizations, business partners, and customers in the process of implementing e-payment services, caused by the perspective of the MSMEs themselves that their business is small and only capable of meeting the daily turmoil, including being influenced by factors of limited competence and human resource capabilities, causing a lack of ability to analyze changes in a period of disruption. One such significant disruption is the switching of payment method from cash to e-payment. For this reason, the strategy that needs to be carried out is to provide socialization and training for MSMEs in order for them to be able to adequately analyze changes such that they can adjust to the needs of business partners and especially customers. Programs of the Ministry of Cooperatives and SMEs in the current pandemic era have been directed at efforts to raise the class of MSMEs through various trainings conducted online through the MSMEs' campus. This training is expected to improve the ability of MSMEs, especially in terms of governance indicators.

*Success of Development.* There are problems related to the implementation of MSME e-commerce service systems that do not yet follow the required business processes and capabilities due to the limited capacity and capability of MSMEs to create such applications. Many MSMEs have difficulty in building and, especially, operationalizing such systems. Therefore, many have turned to utilizing social media for marketing and marketplace for selling. Such limited conditions cause MSMEs to lack the resources for e-commerce development. The strategy and solution to this problem involves MSMEs optimizing their social media and marketplace presence. The cost of building and operating e-commerce services is high, such that MSMEs fear that it will harm them. For internal needs, they may take advantage of digital products that are becoming increasingly affordable, such as applications aimed at point-of-sale and accounting functions.

*Cost Saving.* A key problem that occurs is that MSMEs have not been able to maximize the positive impact obtained by reducing operational costs through the implementation of e-commerce services. As previously thought, MSMEs should choose a solution that is not burdensome when operationalizing later. Strategies and solutions involve optimizing various services on social media for marketing, as well as buying and selling transactions through various marketplace platforms. Experience shows that many MSMEs have failed to build and operate their e-commerce platform.

#### 4.6.2. Expert in Supply Chain

*Adaptability.* There are three problems with this indicator: First, MSMEs have not been able to monitor the development of the business environment to find new market opportunities, judging from the distribution of employees or MSME human resources, and their ability to understand strategies remains sub-optimal. Furthermore, the opportunity to access benchmarking data for similar MSMEs may not be available. To address this problem, the human resources capabilities of MSMEs and facilities need to be improved, by associations or regulators, and they should stay up-to-date with new market opportunities. Second, MSMEs have not been able to find new suppliers to adjust to market changes, which may be due to an inability to conduct market research and sub-optimal supplier relationship management, as well as a lack of ability to understand and develop various types of contracts with suppliers. The solution to this problem involves assistance in improving SRM capabilities and market research for MSMEs. The third problem is that MSMEs have not been able to measure their products compared with similar products in the market; this is due to an inability to survey consumer satisfaction, which would capture the voice of customers, and as customer relationship management has not been implemented properly. Therefore, CRM capabilities should be improved and products and certifications (e.g., SNI, halal food, BPOM) should be standardized in order to be more credible in the eyes of customers.

*Alignment.* The first problem with this indicator is that MSMEs cannot deliver orders to consumers on time. Thus, it is necessary to conduct value stream mapping to determine which processes need to be more efficient; it is also necessary to conduct training and assistance to improve responsiveness and implementation (e.g., using the SCOR 12 racetrack model). Second, MSMEs cannot yet minimize the total costs in the production process, such that it is necessary to identify the composition of costs in order to determine the cost-cutting strategy. For this, again, it is necessary to conduct training and assistance in cost efficiency (perhaps also implemented using the SCOR 12 racetrack model). Third, MSMEs have not been able to minimize waste in the purchase of raw materials; as such, it is necessary to identify the sources of waste and to promote lean manufacturing training in MSMEs.

*Process Integration.* The key problem that occurs is that MSMEs have not been able to carry out proper integration into logistics activities, such that the MSMEs cannot cooperate in creating sustainable and efficient flows derived from raw materials and resources; for this, it is necessary to enhance the readiness of the HR system and that of the financial infrastructure in terms of collaborating with outside parties. Intensive collaboration can be initiated from high-value and high-risk activities, while activities with low value and low risk can be carried out through transactional relationships. Then, the process of initiating MSME involvement in associations, cooperatives, or associations can enhance the power of buyers. Sourcing strategies also need to be fostered in MSMEs.

## 5. Conclusions

We measured the effects of the use of e-payment and e-commerce services on supply chain performance, in order to support the digitization of MSMEs, through multiple linear regression analysis. The results showed that each independent variable had a statistically significant positive effect on a dependent variable. An R value of 0.868 was obtained, indicating that there exists a strong relationship between the use of e-payment and e-commerce services with the MSME supply chain performance, while the obtained R-squared value of 0.754 can be interpreted as the use of e-payment and e-commerce services having a significantly positive influence on the performance of the MSME supply chain.

The values of research indicators were assessed using a descriptive analysis method, from which we found seven research indicators that contributed highly to the readiness (and even acceleration) of MSME digitization in Indonesia, namely communication improvement (84.76%), long-term relationship (83.17%), information sharing (82.56%), awareness (77.77%), commitment (77.68%), agility (73.99%), and overall satisfaction (64.60%).

Interviews and discussions with research experts were conducted to formulate the implications of open innovation and solutions for acceleration of the digitization of MSMEs in Indonesia. The key findings consisted of increasing capabilities in digital literacy, training and assistance in the use of e-payments, utilizing cellular infrastructure with a tested and wider network, implementing socialization and training through the MSME campus, cooperation with research institutions and universities, optimizing the use of social media and marketplaces, introducing digital marketing strategies, improving HR capabilities, initiating MSME involvement by associations or regulators, implementing market research for MSMEs, creating product standardization and certification, conducting customer satisfaction surveys, making value stream maps, assisting improving responsiveness, implementing the SCOR 12 racetrack model, and developing effective cost-cutting, lean-manufacturing, and sourcing strategies.

### *5.1. Practical and Managerial Implication*

The measurement of the effect of e-payment and e-commerce services on the MSME supply chain performance in this study showed that the use of these services in business processes can have a significant influence on the performance of the MSME supply chain, supported by many benefits that may be obtained by MSMEs that can aid in accelerating the digitization of business processes. The results of this study describe the implications of open innovation and solutions for each research indicator in order to help and facilitate MSME actors to follow up on applications in MSME business processes. This research provides direction to MSME players in terms of steps toward developing digital business processes in accordance with both the needs and the problems or the challenges faced by MSMEs. This research can also help with the recovery of MSMEs affected by the COVID-19 pandemic, helping such MSMEs to maintain their business through the implementation of digitization processes. It has previously been shown [31] that the use of online systems can help MSMEs to survive during pandemic periods. The implementation of digitalization must be supported by innovations implemented by MSME actors and it is extremely necessary to gain support from and cooperate with the government and related institutions in order to implement indicators that cannot be reached by the MSMEs themselves.

The results of this study can help the government in accelerating the 30 Million MSMEs Go Digital by 2024 program. The government's direction for e-payment and e-commerce services to be included in the supply chain flow can be enhanced through this research, where e-payment and e-commerce services were shown to have a significant influence on the performance of the MSME supply chain. The results provided herein can also help the government to formulate future directions and policies related to the digitization of MSMEs and to develop the right steps toward helping and collaborating with MSMEs to enhance the digital ecosystem. The results of this study can also help relevant institutions to provide appropriate assistance in accordance with the needs of MSMEs in the context of the digitization process.

### *5.2. Theoretical Implication*

Studies have shown that the use of e-payment and e-commerce services provides many benefits to MSMEs. In this study, we intended to measure the effect of the use of e-payment and e-commerce services on supply chain performance through three research variables, namely e-payment services, e-commerce services, and supply chain performance. Compared with previous studies, in this study joint testing was carried out to determine whether e-payment and e-commerce services had significant effects specifically on the performance of the MSME supply chain. Previous research has presented theoretical formulations of the influence of the use of e-payment and e-commerce services separately on MSMEs, while in this study e-payment and e-commerce services were tested both jointly and individually with respect to their impact on the performance of supply chains in MSMEs in Indonesia; a formulation not considered in previous research. The results of this study also provide additional insights and implications for open innovation and solutions

based on value indicators for the digitization of MSMEs in Indonesia in accordance with the latest conditions.

### 5.3. Limits and Future Research Topics

This research certainly had limitations that can be addressed in further research. First, it is necessary to develop research on the use of e-payment and e-commerce services specifically based on the types of facilities used in each service in order to determine which facilities contribute more to organizations and which increase customer interest. Second, the implications of the innovations and solutions presented in this study need to be assessed in further research in order to evaluate their effectiveness, determine their suitability with respect to the type and location of a given MSME, and determine how the impact may improve the economy in Indonesia. Third, future research can also evaluate the moderating effect or the effects of other variables, thus supporting further improvement of MSME supply chain performance; for example, e-logistics, which can be used to measure the influence of manufacturing applications or supply chain applications on companies, may have an impact on digitalization in MSMEs.

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