The Impact of Technological, Organisational, Environmental Factors on The Adoption of QR Code Indonesian Standard and Micro Small Medium Enterprise Performance

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Abstract: Adoption of QR Code Indonesian Standard (QRIS) technology can simplify payment transactions and improves MSMEs' efficiency. However, QRIS has not been fully adopted by MSMEs in Indonesia, reflected by a relatively low adoption rate. Therefore, this study uses the Technology, Organization, Environment (TOE) framework to analyse the influence of TOE factors on QRIS adoption and the impact on the MSMEs performance. This study used questionnaires gathered from 299 MSMEs in Indonesia and Structural Equation Modeling (SEM) approach to assess the hypotheses. The findings show that the adoption of QRIS is determined by organisational and environmental factors, while technological factors have no significant effect. Furthermore, this study proves that QRIS adoption has a significant impact on the MSMEs performance. Based on the findings, this study suggests the importance of collaboration between regulators and Payment Service Providers to provide education and assistance to MSMEs to increase the adoption of QRIS.

Keywords: QR Code Indonesian Standard, QRIS, Technological-Organisational-Environmental Factors, TOE Framework, Micro Small Medium Enterprise, MSME

1. Introduction

The digital payment system in Indonesia is growing rapidly in line with the increasing public acceptance and preference to conduct transactions online, the expansion of digital payments, and the acceleration of digital banking (Monetary Policy Review, 2021; Mehrotra et al., 2015). Non-cash transactions in Indonesia using electronic money (e-money) show an increasing trend, growing 57.38% year on year or reaching IDR 23.7 trillion in May 2021. The volume of digital banking transactions also sees an upward trend, reaching 601.2 million transactions in May 2021 or increasing 56.49% year on year (Monetary Policy Review, 2021). The increasing trend in the digital ecosystem also benefits from expanding e-commerce transactions (JP Morgan Global Payment Trends, 2019). The adoption of non-cash payment for e-commerce transactions has also increased, reaching IDR 548 million in Q1 2021 (Monetary Policy Review, 2021). Such non-cash payments involve fund transfers, e-money, and electronic wallets (Wasiaturrahma et al., 2019).

Covid-19 pandemic accelerates the adoption of digital transformation (De' et al., 2020). One of the urgencies is to minimise contact when making transactions by utilising digital/touchless payment technology (Gardner, 2020; Samantha, 2020; WHO, 2020). The shift in the public's behaviour in conducting non-cash payment transactions during the Covid-19 pandemic has also forced business players, especially Micro, Small, and Medium Enterprises (MSME), to transform digitally (Bhandari, 2020; e-Conomy SEA Report, 2020). One of the digital payment technologies currently used by MSMEs is QR Code technology. QR Code technology simply requires a smartphone camera to conduct electronic payment (Yue and Mingjun, 2006). It has been an appealing option in transaction payments because of its benefits: a faster payment process (Hossain et al., 2018; Yan et al., 2021).

To help simplify electronic payment and encourage MSMEs to go digital, Bank Indonesia issued QRIS (Indonesia Payment Systems Blueprint, 2019). QRIS technology provides various advantages such as efficient, faster and recorded payment transactions. Furthermore, QRIS transactions are conducted safely since Bank Indonesia supervised the transactions. QRIS transactions are also more hygienic (eliminating the need for physical contact), which are convenient, especially during the Covid-19 pandemic (QRIS Socialization Material, 2019). The adoption of QRIS as a non-card digital payment technology can help improve the efficiency of MSMEs with better financial management. Furthermore, the recorded QRIS transactions could also serve as a source of information for digital data formation related to creditworthiness (Indonesian Economic Report, 2021; QRIS Socialization Material, 2019).

Despite its various benefits, MSMEs have not fully adopted QRIS technology in Indonesia, as reflected in the relatively low adoption rate of 11.83% as of June 2021 (QRIS Statistic, 2021). The relatively low level of digital payment adoption by MSMEs are caused by limited access to digital technology ((Najib and Fahma, 2020), limited information and human resource capacity (Irjayanti and Azis, 2012), concerns about security and difficulties in using technology (Raharja et al., 2019), as well as the lack of monitoring and evaluation from regulators on MSMEs capacity building programs (Suryahadi et al., 2010).

Various studies using the TOE (Technology, Organization and Environment) framework have analysed the influencing factors of MSMEs' adoption of digital payment technology. One of them is done by Kwabena et al. (2021), which states that technological factors (relative advantage, compatibility), organisational factors (top management support, employee readiness) and environmental factors (social influences, competition) have a significant effect on the adoption of digital payment technology. Adoption technologies then significantly affect the performance of MSMEs. Therefore, this study aims to analyse the influence of technological, organisational and environmental factors (TOE framework) in the adoption of QRIS technology and their effect on MSME performance in Indonesia. This study will be useful for regulators (Bank Indonesia) in an effort to increase the acceptance of QRIS adoption by MSMEs. On the MSME side, it will provide information about the role of QRIS in improving its performance.

2. Literature Review

Micro Small Medium Enterprise (MSMEs)

MSMEs have a significant role in promoting economic growth and ensuring equitable and sustainable development for a country (Kerr et al., 2014). MSMEs have a substantial contribution to the economy in Indonesia, amounting to 57.14% of the Gross Domestic Product. MSMEs also absorb 96% of the total workforce in Indonesia (MSME Statistics, 2019).

Table 1. MSMEs Category in Indonesia

Category	Net Worth (excluding land and buildings) - IDR	Annual Sales Turnover (IDR)	Workforce
Micro	Less than 50 million	Less than 300 million	1 – 4 people
Small	50 million – 500 million	300 million – 2.5 billion	5 – 19 people
Medium	500 million – 10 billion	2.5 billion – 50 billion	20 – 99 people

Source: Law of The Republic of Indonesia Number 20, 2008; Central Bureau of Statistics

There are several categories of MSMEs based on net worth (excluding land and buildings) and annual sales turnover (Law of the Republic of Indonesia Number 20; 2008), as shown in Table 1.

MSMEs in the micro business category dominate the number of MSMEs in Indonesia, with a share of 98.68% (64,601,352 business units) in 2019. This figure has increased by 1.97% compared to 2018. From 2018 to 2019, small business units also increased by 1.99%, from 783,132 business units to 798,679 business units. Whereas medium business units (with a share of 0.1%) experienced an increase in the number of business units from 60,702 business units in 2018 to 65,465 business units in 2019 (MSME Statistics, 2019).

QRIS Technology

QRIS is a standardised digital payment technology using a smartphone application based on QR Code issued by Bank Indonesia (Indonesia Payment Systems Blueprint, 2019). QR Code technology-based payments have been widely used by Payment Service Providers (PSP) in Indonesia, such as Go-Pay, OVO, Dimo Pay, and others (Deloitte, 2018). Variation in the specification of QR Codes creates obstacles for users in downloading applications from each PSP, which could cause inefficiency in payment transactions (QRIS Socialization Material, 2019; Indonesia Payment Systems Blueprint, 2019). QRIS is developed by Bank Indonesia and the Indonesian Payment System Association referring to the international standard Europe MasterCard Visa Co (Indonesia Payment Systems Blueprint, 2019). This standard aims to support interconnection and interoperability between providers, instruments, and countries. QRIS technology ensures that the QR Code transaction becomes more accessible, faster, safer, and more efficient (QRIS Socialization Material, 2019).

Table 2. QRIS Users

Category	Number of Units (million units)	Share to Total Units
Micro	4.72	63.71%
Small	2.00	27.05%
Medium	0.68	9.24%
Total MSMEs	7.40	

Source: QRIS Statistic, 2021

QRIS implementation accelerates MSMEs' access toward digital payment (Indonesia Payment Systems Blueprint, 2019; QRIS Socialization Material, 2019). QRIS adoption of retail merchants all over Indonesia amounts to 7.74 million as of June 2021. Almost all (7.40 million) of the merchants are MSMEs, as shown in Table 2. Nevertheless, the adoption of QRIS is still relatively low, covering only 11.83% of the total MSMEs in Indonesia (QRIS Statistic, 2021).

QRIS adoption will benefits MSMEs, which includes: (1) faster transaction process, (2) cheaper fees, as reflected in lower Merchant Discount Rate fees compared to QR Code or using credit/debit cards, (3) recorded transactions, which could help MSMEs manage their finances, (4) ability to build credit profiles with transaction history in banks, (5) hygienic transactions, which minimise the need for physical payment exchange, (6) reduced risk of theft and counterfeit money (QRIS Socialization Material, 2019; Indonesia Payment Systems Blueprint, 2019).

TOE (*Technology, Organization, Environment*) Framework

One of the classical theories used to explain human behaviour in adopting and using new technologies is the TAM (Technology Acceptance Model) theory. TAM theory is an advancement from the Theory of Reasoned Action (TRA) developed by Davis (1989). TAM theory has been proven robust in predicting the factors that influence technology adoption (Alalwan et al., 2017; Lee et al., 2003). The TAM model found that usefulness and perceived ease of use significantly influenced adopting new technology (Najib and Fahma, 2020; Purnamasari et al., 2020). Perception of usability describes a company's perception of the usefulness of technology in improving company performance (Alsamydai, 2014; Rafique et al., 2020); while perceived ease of use describes how companies view technology adoption as a natural process (Davis, 1989; Nunkoo et al., 2013). TAM theory has been widely applied to determine attitude towards technology adoption, although Wong et al. (2020) argue that the theory ignores organisational and environmental factors.

As a further extension of the TAM model, the TOE (Technology, Organization, and Environment) framework (Tornatzky et al., 1990) uses technological factors and involves organisational and environmental factors to determine the influencing factors on the adoption of specific technologies. Several studies have confirmed the comprehensiveness of the TOE model to explain the adoption of IT innovations (Taheer et al., 2018; Tajudeen et al., 2018). Thus, theoretically and empirically, the TOE framework could be used to identify the adoption of new technologies by MSMEs (Cao et al., 2018; Erusalkina et al., 2019; Khan and Ali, 2018; Kwabena et al., 2021; Qalati et al., 2021).

There are three factors within the TOE framework, namely technology, organisation and environment. Technological factors consist of external and internal technologies that are important to the business (DePietro et al., 1990). Organisational factors include company size, management level, resources and other related issues (Ahmad et al., 2019; Khan and Ali, 2018; Tajudeen et al., 2018). Environmental factors relate to stakeholders such as competitors, consumers, suppliers, governments, and others (Erusalkina et al., 2019; Kwabena et al., 2021). There have been studies carried out using the TOE framework to determine MSMEs readiness to adopt information technology innovations such as e-commerce (Hussain et al., 2020), e-business (Hadi Putra and Santoso, 2020), electronic payment (Taheer et al., 2018), social media (Ahmad et al., 2019; Effendi et al., 2020; Pateli et al., 2020; Qalati et al., 2021), digital payment (Erusalkina et al., 2019), and mobile payment (Cao, 2021; Kwabena et al., 2021; Otieno and Kahonge, 2014).

Cao (2021), Kwabena et al. (2021), and Erusalkina et al. (2019) use the TOE framework to identify the factors that influence the use of mobile payment and their effect on the performance of MSMEs. The research findings state that technological factors (compatibility, relative advantage), organisational factors (top management support, employee readiness), and environmental factors (social influences, competition) significantly affect the adoption of mobile money. Kwabena et al. (2021) use technological factors (compatibility, relative advantage), organisational factors (top management support, employee readiness), environmental factors (social influences,

competition), the use of mobile payments and MSMEs performance. Meanwhile, Cao (2021) uses four independent variables that are considered to affect the desire to use mobile payments. They are business factors (employee education, type of business, business readiness, cost of using technology), technology factors (internet connection, resilience, compatibility), environmental factors (regulations, stakeholder support, consumer literacy), and consumer intention (trustworthiness, safety, convenience, usability, consumer readiness).

Furthermore, several studies looked at the effect of technology adoption on the performance of MSMEs. Research on the adoption of digital payment technology conducted by Kwabena et al. (2021), Erusalkina et al. (2019), Tengeh and Talom et al. (2019) found that mobile payment has a significant influence on the performance of MSMEs. Additionally, other research has confirmed the significant effect of social media adoption on MSMEs performance (Ahmad et al., 2019; Cao et al., 2018; Qalati et al., 2021; Tajudeen et al., 2018).

Research Model and Hypotheses Development

The research framework of this study focuses on the factors that influence MSMEs to adopt QRIS as a digital payment technology and examines the effect of using QRIS on MSMEs performance. It is based on the literature study from previous researches that utilised the TOE framework to identify the factors that influence technology adoption. Research by Kwabena et al. (2021), Cao (2021) and Erusalkina et al. (2019) stated that technological, organisational and environmental factors significantly influence the desire of MSMEs to use mobile payment technology. The research framework is further combined with several other studies that examine the influence of technology adoption (mobile money, social media, e-commerce) on the performance of MSMEs. Several studies have found that technology adoption (digital payments, mobile money, social media, e-commerce) positively influences MSMEs performance (Erusalkina et al., 2019; Hussain et al., 2020; Kwabena et al., 2021; Qalati et al., 2021). Based on this, the research framework that underlies this research can be seen in Figure 1.
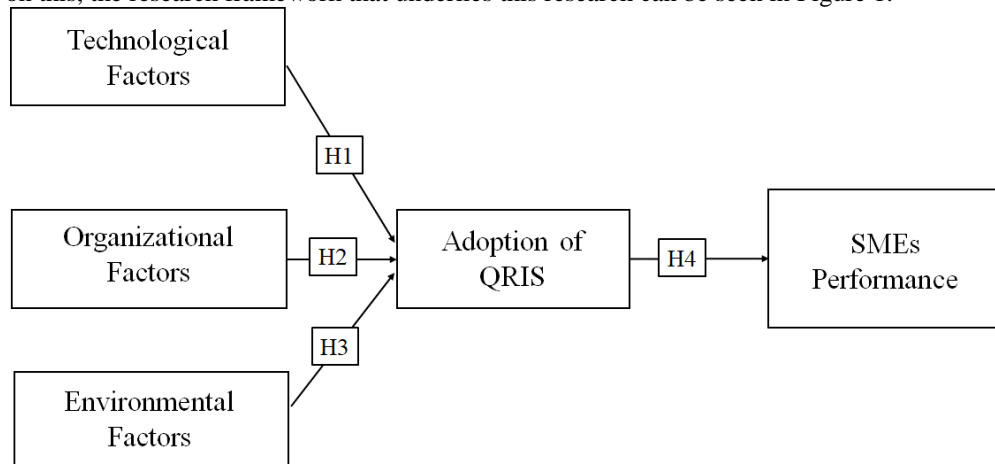

Figure 1. Research Model

Based on the research model, the following research hypotheses were thus formulated:

Technological Factors

Technological factors are the expected characteristics of the technology to be used (DePietro et al., 1990). This study uses three characteristics of technological factors, namely ease of use (Masocha and Dzomonda, 2018; Tengeh and Talom, 2020), security (Igudia, 2016; Taheer et al., 2018; Otieno and Kahonge, 2014; Tengeh and Talom, 2020) and relative advantages (Erusalkina et al., 2019; Kwabena et al., 2021; Masocha and Dzomonda, 2018; Najib and Fahma, 2020; Otieno and Kahonge, 2014) that will affect the use of QRIS technology. Several studies found that technological factors influence the adoption of digital payment technology (Cao, 2021; Erusalkina et al., 2019; Igudia, 2016; Kwabena et al., 2021). Based on the results of these studies and considering QRIS as a digital payment technology, the following hypotheses can be proposed:

H1 : Technological factors have a positive and significant effect on QRIS adoption

Organisational Factors

Organisational factors refer to the characteristics of an organisation in terms of scope and size (Tajudeen et al., 2018). This study uses three factors in the organisation, namely knowledge (Cao, 2021; Masocha and Dzomonda, 2018), top management support (Ahmad et al., 2019; Khan and Ali, 2018; Tajudeen et al., 2018), and organisational readiness (Cao, 2021; Taheer et al., 2018; Otieno and Kahonge, 2014; Yoon, 2009). According to

Erusalkina et al. (2019), organisational factors are internal characteristics of an organisation that can be measured from company size, organisational structure and culture, employee behaviour, and others. Several studies conducted by Kwabena et al. (2021), Cao (2021), and Erusalkina et al. (2019) stated that organisational factors significantly influence the use of digital payment technologies such as mobile payments. Based on these studies and considering that QRIS is one of the digital payment technologies, the following hypotheses can be proposed:

H2 : Organisational factors have a positive and significant effect on QRIS adoption

Environmental Factor

Several studies found that environmental factors, which include aspects outside the organisation, influenced the desire of MSMEs to use digital payment technology. This study uses four factors, namely competitive pressure (Igudia, 2016; Lubua and Semlambo, 2017; Otieno and Kahonge, 2014; Xena and Rahadi, 2019), technology infrastructure (Hadi Putra and Santoso, 2020), third party support and regulatory support (Cao, 2021; Igudia, 2016). Research conducted by Cao (2021), Kwabena et al. (2021), Otieno and Kahonge (2014) suggested that environmental factors significantly influence the intention of MSMEs to use mobile payments. Erusalkina et al. (2019) also stated that environmental factors significantly affect digital payment technology adoption by MSMEs in Ghana. Based on several previous research results and considering that QRIS is one of the digital payment technologies, the following hypotheses can be proposed:

H3 : Environmental factors have a positive and significant effect on QRIS adoption

Adoption of QRIS and MSMEs Performance

Technological innovation can create added value for a company (Yun et al., 2020). As one non-card digital payment technology innovation that aims to simplify the payment transaction process, QRIS is expected to improve MSMEs' performance. Previous research found a positive relationship between technology adoption (mobile payment, social media, e-commerce) and MSMEs performance (Cao et al., 2018; Kwabena et al., 2021; Taheer et al., 2018; Tengeh and Talom, 2019). This research focus on the financial performance of MSMEs, which is represented by an increase in the number of transactions, sales, profits, and a decrease in costs such as technology fees, physical money management costs (Cao et al., 2018; Erusalkina et al., 2019; Kwabena et al., 2021; Tajudeen et al., 2018; Tengeh and Talom, 2019). QRIS, as a digital payment technology, is expected to accelerate the payment process, facilitate payments, reduce the cost of handling physical money, and increase sales. Because research in the context of the adoption of QRIS and its influence on the performance of MSMEs is still limited, the following hypotheses can be proposed:

H4 : QRIS adoption has a positive and significant effect on the performance of MSMEs

3. Methodology

This study utilises the SEM approach to analyse data as used in previous studies related to technology adoption (Cao et al., 2018; Erusalkina et al., 2019; Hussain et al., 2020; Kwabena et al., 2021; Taheer et al., 2018; Qalati et al., 2021; Tajudeen et al., 2018). SEM is a statistical method used to evaluate structural relationships (Anderson and Gerbing, 1988) and is a combination of multiple regression with factor analysis to assess the relationship between variables (Chin, 1998).

Sample and Data Collection

This study uses non-probability sampling with purposive sampling technique, which uses specific criteria following the research objectives. The criteria for the respondents of this study are MSMEs that have QRIS located in the Provinces of West Java, East Java, Central Java and DKI Jakarta and use QRIS in payment transactions. The selection of the four regions in the research sample category above refers to the study population, where the number of MSMEs using QRIS from the four provinces (West Java, East Java, Central Java and DKI Jakarta) represents 60% of the total number of MSMEs using QRIS in Indonesia. Determination of the number of samples uses the G-Power Statistic application (Hair et al., 2017) with a significance level (α) = 0.05, statistical power = 95%, effect size = 0.1 and the number of predictors = 4. Based on calculations using the G-Power Statistic application, the minimum number of research samples is 191 respondents. This study uses a self-administered questionnaire through an online survey to collect data from MSMEs. Questionnaires were distributed to 598 MSMEs with 299 valid responses from MSMEs that met the respondent's criteria.

Instruments

This study utilises a five-point Likert scale to record respondents' responses. Question items that build exogenous variables (technological factors, organisational factors, environmental factors) and intervening variables (use of QRIS) were measured using a 5-point Likert scale with an answer range of 1 ("strongly disagree"), 2 ("disagree"), 3 ("neutral"), 4 ("agree") and 5 ("strongly agree"). The measurement scale is used to measure attitudes, opinions and perceptions of the statements given. The statement items used were adopted from several studies on technology adoption and adjusted according to the characteristics of QRIS technology adoption, as shown in Table 3.

Table 3. Measurement Items

Constructs	Measurement Items	Reference
Technological Factors (TF)		
Ease of Use	TF1, TF2, TF3	Najib and Fahma, 2020; Nyaga, 2013
Security	TF4, TF5, TF6, TF7	Taheer et al., 2018; Najib and Fahma, 2020; Tengeh and Talom, 2020
Relative Advantage	TF8, TF9, TF10, TF11	Chale and Mbamba, 2014; Mbogo, 2010; Najib and Fahma, 2020; Tengeh and Talom, 2020
Organisational Factors (OF)		
Knowledge	OF1, OF2, OF3, OF4	Anggadwita and Mustafid, 2014; Hanggraeni and Sinamo, 2021; Herlinawati et al., 2019; Kwabena et al., 2021
Top Management Support	OF5, OF6, OF7	Anggadwita and Mustafid, 2014; Taheer et al., 2018; Qalati et al., 2021
Organizational Readiness	OF8, OF9	Najib and Fahma, 2020; Otieno and Kahonge, 2014
Environmental Factors (EF)		
Competitive Pressure	EF1, EF2, EF3, EF4, EF5, EF6, EF7, EF8	Cao et al., 2018; Igudia, 2016; Hanggraeni, 2010; Taheer et al., 2018
Technology Infrastructure	EF9	Cao, 2021; Hadi Putra and Santoso, 2020
Third-Party Support	EF10	Cao, 2021; Hadi Putra and Santoso, 2020; Tengeh and Talom, 2020
Regulator Support	EF11, EF12, EF13	Hussain et al., 2020; Igudia, 2016; Tambunan, 2019
Adoption of QRIS (QRIS)	QRIS1, QRIS2, QRIS3, QRIS4, QRIS5	QRIS Socialization Material, 2019; Hadi Putra and Santoso et al., 2020
MSMEs Performance (PER)	PER1, PER2, PER3, PER4	Ainin et al., 2015; Cao et al., 2018; Hadi Putra and Santoso, 2020; Hussain et al., 2020; Kiyabo and Isaga, 2020; Kwabena et al., 2021; Odoom et al., 2017; Tajudeen et al., 2018

The endogenous variable measurement scale (MSMEs performance) developed in this study uses statements to assess perceptions instead of objective measurements. The question items in the study determine respondents' perceptions of MSMEs' performance improvement (sales, number of transactions, profits, costs) after adopting QRIS technology. The perception assessment approach is employed due to the difficulty to assess MSMEs' financial information (Taheer et al., 2018). Several similar studies have found that MSMEs' financial information is likely unavailable, accurately unreliable, and difficult to clarify (Woodcock et al., 1994). The perception approach assessment is generally considered reliable and has shown consistent results with objective measurements in previous studies (Ainin et al., 2015; Dess and Robinson, 1984). The statement that composes

MSMEs performance variables uses a 5-point Likert Scale with answers ranging from 1 ("greatly decreasing"), 2 ("decreasing"), 3 ("neutral"), 4 ("increasing"), and 5 ("greatly increasing"). The MSMEs performance variable employs four-question items, as shown in Table 3.

Pilot Survey

The pilot survey was conducted on June 13, 2021, by distributing an online survey to 33 respondents with a response rate of 100%. The average respondent takes about 7 – 10 minutes to complete the survey questionnaire based on the pilot survey. The results of the pilot survey were then tested for validity and reliability using SPSS version 25 software. The validity test results of all questions in each variable showed that all questions were declared valid with a significance value < 5% and R greater than R Table. Furthermore, the reliability test results showed that all research variables were reliable, as seen from the Cronbach Alpha value greater than 0.7.

4. Results

Descriptive Information

Based on the survey results, 580 respondents filled out the questionnaire were in four provinces (Central Java, West Java, DKI Jakarta, East Java). Out of 580 respondents, 51.6% (299) have used QRIS, and 48.4% of respondents (281) did not have QRIS. Based on the criteria of research respondents, only 299 responses will be processed to test the research hypotheses. Table 4 shows that out of 299 respondents, 131 (43.8%) are over 41 years old, and 69 (23.1%) are between 36 – 40 years old. Most (270 or 90.3%) respondents are MSME owners and have a D4/Bachelor background as many as 133 (44.5%), D1/D2/D3 as many as 52 (17.4%). This result shows that the respondents are decision-makers in MSMEs and have a relatively good educational background. Regarding the size of MSMEs, 216 (72.2%) are in the micro category with an annual sales turnover of < 300 million, and the number of employees is 1-4 people. The sample contains MSMEs with the type of food and beverage business as many as 179 (59.9%), 60 crafts (20.1%) and 60 textiles or fashion (20.1%). Most MSMEs obtained information about QRIS from BI (46.5%), banks (16.7%), and the internet and social media (13.4%). Most MSMEs have used QRIS for more than three months with the details of 3-6 months (22.4%), 6-12 months (32.1%) and more than one year (31.8%).

Table 4. Demographical Statistics of Respondents and MSMEs

Demographic Information	Frequency	Percentage
Respondent Profile		
Age		
• 25 – 30 years old	50	16.7%
• 31 – 35 years old	49	16.4%
• 36 – 40 years old	69	23.1%
• More than 41 years old	131	43.8%
Job position		
• MSMEs owner	275	91.9%
• Management level	24	8.0%
• Employee	0	0
Education		
• Elementary level	1	0.3%
• Junior/senior high school	89	29.8%
• Diploma 1/2/3 (D1/D2/D3)	52	17.4%
• Diploma 4/Bachelor's degree	133	44.5%
• Graduate/Postgraduate degree (Master/Doctoral degree)	24	8%
MSMEs Profile		
Location		
• West Java Province	78	26.1%
• DKI Jakarta Province	59	19.7%
• East Java Province	84	28.1%
• Central Java Province	78	26.1%
Business type		
• Food and beverage	179	59.9%
• Craft	60	20.1%
• Textile (Fashion)	60	20.1%

Years in business			
• < 3 years	61	20.4%	
• 3 – 5 years	98	32.8%	
• 5 – 10 years	85	28.4%	
• > 10 years	55	18.4%	
Number of employees			
• 1 – 4 person	148	49.5%	
• 5 – 19 person	132	44.1%	
• 20 – 99 person	19	6.4%	
Total asset			
• IDR < 50 million	137	45.8%	
• IDR 50 – 500 million	134	44.8%	
• IDR > 500 million	28	9.4%	
Sales turnover			
• IDR < 300 million	216	72.2%	
• IDR 300 million – 2.5 billion	79	26.4%	
• IDR 2.5 – 50 billion	4	1.3%	
MSME category			
• Micro enterprise	216	72.2%	
• Small enterprise	79	26.4%	
• Medium enterprise	4	1.3%	
MSME and QRIS			
Source of information for QRIS			
• Bank Indonesia	139	46.5%	
• Banks	50	16.7%	
• Payment Service Providers (e.g. Gopay, OVO)	23	7.7%	
• Internet, social media	40	13.4%	
• Exhibition	33	11%	
• MSMEs community	14	4.7%	
QRIS adoption			
• < 3 months	41	13.7%	
• 3 – 6 months	67	22.4%	
• 6 – 12 months	96	32.1%	
• > 1 year	95	31.8%	

Model Analysis and Results

This study employs the Partial Least Square Structural Equation Modeling (PLS-SEM) approach using Smart PLS 3.0 to test the hypothesis. The SEM method allows researchers to model and simultaneously estimate and test complex theories with empirical data (Hair et al., 2014). PLS-SEM is a variance-based method for estimating structural equation models to maximise the explained variance of endogenous latent variables (Hair et al., 2014). This approach has been widely used in various fields of science such as social sciences, business management and other sciences. According to Hair et al. (2019), there are two steps in conducting analysis using PLS-SEM, namely (1) assessment of measurement model and (2) assessment of the structural model. Before analysing the measurement and structural models, we have tested for multicollinearity using the Variance Inflation Factor (VIF). This approach is used to detect multicollinearity in regression analysis (Li et al., 2020). This study is free from multicollinearity as indicated by an inner VIF value of less than 5 (Basri and Siam, 2019), as shown in Table 5.

Table 5. Measurement Model for the First Order and Second Order

Construct	Loadings	CA	CR	AVE	Inner VIF
Technological Factors (TF)		0.870	0.898	0.525	1.945
Ease of Use	0.797	0.735	0.883	0.790	1.000
Security	0.917	0.799	0.870	0.627	1.000
Relative Advantage	0.825	0.751	0.889	0.800	1.000
Organisational Factors (OF)		0.905	0.924	0.605	2.578
Knowledge	0.923	0.837	0.891	0.672	1.000
Top Management Support	0.914	0.884	0.929	0.867	1.000
Organizational Readiness	0.717	1.000	1.000	1.000	1.000

Environmental Factors (EF)		0.888	0.910	0.531	2.317
Competitive Pressure	0.947	0.855	0.896	0.633	1.000
Technology Infrastructure	0.680	1.000	1.000	1.000	1.000
Vendor Support	0.770	1.000	1.000	1.000	1.000
Regulator Support	0.714	0.847	0.929	0.867	1.000
Adoption of QRIS (QRIS)		0.776	0.849	0.531	2.814
MSMEs Performance (PER)		0.923	0.946	0.815	

Assessment of Measurement Model

According to Freixanet et al. (2021), the proposition to measure a model is needed to assess the reliability of individual items, internal consistency, content validity, convergent validity and discriminant validity. The reliability of individual items is measured by the outer loading of each item associated with a particular construct. Ghozali and Latan (2015) suggested that the outer loading value should be greater than 0.6; therefore some items have been removed from the analysis. Reliability is measured using Cronbach's Alpha (CA), where the CA value is acceptable if the value is above 0.7 (Hair et al., 2014). Internal consistency reliability is seen from the composite reliability (CR) value with a value of more than 0.7 (Hair et al., 2019). In terms of convergent validity, Hair et al. (2014) recommend that the Average Variance Extracted (AVE) value be greater than 0.5. Table 6 shows the values of outer loading, CA, CR, AVE and inner VIF to assess reliability, internal consistency, and convergent validity.

This research employs the HTMT interference test to measure the discriminant validity, considering that this research model includes a complex model that uses intervening variables. Further, this research employs bootstrapping procedure with a re-sample of 5000 to obtain a confidence interval (CI) value of less than or equal to 1 to identify no problem with discriminant validity (Henseler et al., 2015). Based on the CI values as shown in Appendix 1, it can be confirmed that there is no problem in discriminant validity.

Assessment of Structural Model

According to Hair et al. (2019), a structural model is used to assess the effects of linear regression from one dependent variable to another. The structural model assessment in PLS-SEM consists of path coefficients, p-value and the coefficient of determination ($R2$). The assessment was carried out using a 5000 re-sample bootstrapping procedure to analyse the hypothesis and significance level (Hair et al., 2019). According to Hair et al. (2017), $R2$ values of 0.75, 0.5, and 0.25 respectively are substantial, moderate and weak. In this study, the $R2$ value is 0.645, where QRIS adoption substantially influences the structural model and shows that TOE factors influence 64.5% of the variation in QRIS adoption. Meanwhile, 49.4% of the variation in MSME performance is influenced by the adoption of QRIS (Table 7).

In addition, this study uses a cross-validated redundancy measure (Q^2) to evaluate the model. Hair et al. (2017) suggest a $Q^2 > 0$, which indicates that the model has predictive relevance. Values of 0.02, 0.15, and 0.35 respectively indicate that exogenous variables have small, medium or large enough predictive relevance for certain endogenous variables (Cohen, 1988). The current research model has moderate predictive relevance for QRIS adoption and MSME performance (Table 8). The goodness of model fit is indicated by the SRMR value of 0.088 or below the accepted threshold, which is < 0.1 (Hair et al., 2014).

Table 7. Path Coefficient and Hypotheses Testing

Hypotheses	Relationship	Path Coefficient	SD	t-Value	p-Value	Decision
H1	TF → QRIS adoption	0.052	0.053	0.992	0.321	Not supported
H2	OF → QRIS adoption	0.390	0.077	5.048	0.000	Supported
H3	EF → QRIS adoption	0.433	0.066	6.553	0.000	Supported
H4	QRIS Adoption → MSME Performance	0.703	0.035	19.909	0.000	Supported

Note: TF = Technological Factors, OF = Organisational Factors, EF = Environmental Factors

Table 8. Structural Model

Variables	Cross Validated Redundancy (Q^2)			Coefficient of Determination (R^2)	
	SSO	SSE	Q^2 (=1-SSE/SSO)	R^2	Adj. R^2
QRIS Adoption	1495	993.742	0.335	0.645	0.641
MSMEs Performance	1196	685.059	0.427	0.494	0.492

Overal model fit: standardized root means square residual (SRMR) = 0.088, d_ULS = 13.567, d_G = n/a; Chi-Square = infinite, NFI – n/a

Table 7 shows that of the four hypotheses developed; one hypotheses is not supported based on the criteria of t-value > 1.96 and p-value < 0.05, namely H1.

5. Discussion

To increase their business, MSMEs have adopted various technologies. Many studies have tried to identify how the adoption of new technology can support MSMEs performance. This study analyses the relationship between technological, organisational, and environmental factors on the adoption of QRIS and MSMEs performance. The study results are quite interesting, considering that as a digital payment technology, QRIS is expected to improve the capabilities and performance of MSMEs in Indonesia amid the rapid growth of the digital economy.

The findings reveal that organisational factors positively and significantly affect the adoption of QRIS by MSMEs. This is indicated by the statistically supported relationship between organizational factors and QRIS adoption formulated in H2 (t-value = 5.048 > 1.96, p-value = 0.000 < 0.05, path coefficient = 0.390). It can be interpreted that internal organisational factors such as knowledge of QRIS, support from top management levels, and organisational readiness (technology-aware work culture, other technical readiness) affect MSMEs' QRIS adoption. The result is consistent with several previous studies, including Kwabena et al. (2021), who argue that organisational factors (top management support, employee readiness) have a significant effect on the adoption of mobile payment technology. Erusalkina et al. (2019) also found that organisational factors (top management support) influenced the adoption of digital payment technology. It is also consistent with the findings of Cao (2021), where organisational factors (business readiness, education, type of business, technology usage cost) have a significant effect on mobile payment adoption. Similar research results were also found in the context of the adoption of other technologies, including social media. The study of Taheer et al. (2018) is consistent with this study, where organisational factors positively and significantly affect social media adoption.

This study also obtained a significant relationship between environmental factors and the adoption of QRIS. The findings show that the relationship between environmental factors and the adoption of QRIS formulated in H3 has a positive relationship (t-value = 6.553 > 1.96, p-value = 0.000 < 0.05, path coefficient = 0.433). Environmental factors employed in this research are competition pressure, technology infrastructure, third-party support (PSP), and regulator (Bank Indonesia). This study indicates that competitive pressure is a crucial factor in the environmental context that affects the adoption of QRIS. MSMEs adopt QRIS as a response to competitors to gain a competitive advantage in serving consumers. Based on the findings, it appears that competitive pressure from various external parties, including consumers and competitors, positively affects the use of technology. These findings are consistent with several previous studies that argued that competitive pressure is an important factor in technology adoption (Erusalkina et al., 2019; Kwabena et al., 2021; Taheer et al., 2018). Regulator support (Bank Indonesia) in socialising and providing education related to QRIS and the active involvement of PSP are important factors in influencing MSMEs to use QRIS. The study results are also consistent with the findings of Cao (2021), where environmental factors (regulations, support from related parties, and consumer literacy) have a significant effect on the adoption of mobile payment technology.

Hypotheses is formulated regarding the technological factor: H1, analysing the effect of technological factors on the use of QRIS. This study found that H1, the relationship between technology factors and QRIS adoption was not statistically significant as indicated by t-value = 0.992 < 1.96, p-value = 0.321 > 0.05, path coefficient = 0.052. This finding means that the technology factor is irrelevant in the MSMEs' decision to adopt QRIS. Therefore, it shows that three indicators of technological factors (ease of use, security, relative advantage) are not the main factors that influence MSMEs to use QRIS. Bank Indonesia develops QRIS by standardising existing QR Code payments in the industry. QR Code payments have been used in the industry since 2018. Some PSPs already using QR Code payments included Gopay, OVO, Yap!, Doku, MyQR, Sakuku, and more. Therefore, some MSMEs are more familiar with the QR Code issued by PSP than QRIS. In addition, most MSMEs are unaware of QRIS technology. From 598 respondents, around 48.4% (281 respondents) have not used QRIS. This data is also due to MSMEs' low level of understanding towards QRIS since QRIS has only been launched in early 2020. This finding is also in line with the research conducted by Ndekwa and Katunzi (2016) and Tajudeen et al. (2018), which states that the technology factor is not significant to technology adoption.

This study also shows that the adoption of QRIS has a positive and significant impact on the performance of MSMEs. The relationship is formulated in H4 with supported statistical results (t-value = 19,909 > 1.96, p-value = 0.000 < 0.05, path coefficient = 0.703). This result shows that the adoption of QRIS increases the number of transactions, sales turnover, and profit while reduces costs such as cash management. The results of this study are in line with the study conducted by Erusalkina et al. (2019), Kwabena et al. (2021), Tengeh and Talom et al.

(2019), which states that the adoption of mobile payment technology affects the performance of MSMEs. In this case, QRIS offers various benefits for MSMEs, including faster and safer transaction processes, recorded transactions in bank accounts, lower costs, consumer increase, and hygienic transactions (Indonesia Payment Systems Blueprint, 2019).

6. Conclusion

This study was conducted to analyse the influence of technological, organisational, and environmental factors on the adoption of QRIS by MSMEs in Indonesia. The study results prove that organisational and environmental factors have a positive and significant influence on QRIS adoption, while technological factors show no effect on the adoption of QRIS. Furthermore, this study confirms that the adoption of QRIS positively and significantly affects the performance of MSMEs. Based on the research findings, this study recommends that the regulator (Bank Indonesia) continue conducting educational programs and assistance to MSMEs, emphasising the benefit of adopting digital payment technology (i.e. QRIS). This study also found that PSP support influenced MSMEs to adopt QRIS; thus, Bank Indonesia could collaborate with PSP and other institutions (Ministry of Cooperatives and MSMEs, MSME Associations, MSME Communities, etc.) on conducting education and assistance.

7. Contributions

Regulator (Bank Indonesia) collaborates with PSP and other institutions should conduct education and assistance to MSME owners or top management levels, especially micro and small MSMEs, considering that 99.29% of the 281 respondents who did not have QRIS were MSMEs in the micro and small category. Another factor influencing the adoption of QRIS is competitive pressure from competitors and consumers. Therefore, the QRIS education program can be provided based on MSME groups and clusters and target MSME consumers. Incentives or awards to MSMEs are also one of BI's forms of appreciation for MSMEs. BI must periodically evaluate and monitor the implementation of QRIS and be open to all feedback to improve this technology.

Most importantly, this study pinpoints that adopting QRIS allows owners and top-level management of MSME to understand the actual significance of QRIS technology. This study facilitates MSMEs' understanding of how QRIS technology can improve MSMEs' performance. As this study reveals, QRIS adoption has significant effects on MSMEs in terms of increasing sales transactions, profit earned, and cost reduction related to handling cash. In addition, QRIS adoption helps MSME check the history of financial transactions, build a credit profile, and reach out more potential customers.

This study also contributes to further academics/researchers to enrich research references regarding the factors that influence MSMEs in adopting digital payment technology, especially QRIS, and the impact on MSME performance. As this study reveals, technological factors have an insignificant effect on QRIS adoption. Therefore, the researcher can develop a research model by adding more specific characteristics of QRIS technology. Furthermore, researchers can explore factors that cause technological factors to be insignificant to QRIS adoption. Based on the findings, 49.4% of the variation in MSME performance is influenced by the adoption of QRIS. Therefore, researchers can add other variables such as the length of MSMEs incorporation, business scale, education of MSME owners, and other factors.

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Appendix

Discriminant Validity – HTMT Inference

	Original Sample (O)	Sample Mean (M)	CI (2.5%)	CI (97.5%)
LK10 <- Vendor Support	1.000	1.000	1.000	1.000
LK10 <- Environmental Factors	0.773	0.773	0.711	0.827
LK11 <- Regulator Support	0.931	0.931	0.904	0.953
LK11 <- Environmental Factors	0.667	0.665	0.566	0.748
LK12 <- Regulator Support	0.931	0.932	0.909	0.953
LK12 <- Environmental Factors	0.669	0.668	0.575	0.747
LK4 <- Competitive Pressure	0.768	0.767	0.696	0.827
LK4 <- Environmental Factors	0.697	0.697	0.622	0.762
LK5 <- Competitive Pressure	0.822	0.822	0.757	0.871
LK5 <- Environmental Factors	0.766	0.766	0.684	0.832
LK6 <- Competitive Pressure	0.811	0.811	0.757	0.855
LK6 <- Environmental Factors	0.811	0.81	0.754	0.857
LK7 <- Competitive Pressure	0.808	0.809	0.751	0.859
LK7 <- Environmental Factors	0.763	0.764	0.699	0.823
LK8 <- Competitive Pressure	0.768	0.769	0.715	0.816
LK8 <- Environmental Factors	0.711	0.711	0.647	0.768
LK9 <- Infrastructure Technology	1.000	1.000	1.000	1.000
LK9 <- Environmental Factors	0.684	0.684	0.596	0.758
OR1 <- Knowledge	0.835	0.834	0.786	0.875
OR1 <- Organizational Factor	0.767	0.766	0.695	0.825
OR2 <- Knowledge	0.886	0.886	0.856	0.913
OR2 <- Organizational Factor	0.860	0.860	0.817	0.896
OR3 <- Knowledge	0.763	0.763	0.697	0.821
OR3 <- Organizational Factor	0.687	0.687	0.606	0.761
OR4 <- Knowledge	0.791	0.789	0.734	0.838
OR4 <- Organizational Factor	0.697	0.696	0.618	0.762
OR5 <- Top Management Support	0.901	0.9	0.868	0.928
OR5 <- Organizational Factor	0.824	0.823	0.771	0.865
OR6 <- Top Management Support	0.929	0.928	0.904	0.948
OR6 <- Organizational Factor	0.848	0.847	0.805	0.882
OR7 <- Top Management Support	0.874	0.873	0.828	0.909
OR7 <- Organizational Factor	0.799	0.799	0.743	0.843
OR9 <- Organizational Readiness	1.000	1.000	1.000	1.000
OR9 <- Organizational Factor	0.717	0.717	0.638	0.782
PER1 <- MSME Performance	0.934	0.935	0.914	0.951
PER2 <- MSME Performance	0.938	0.938	0.917	0.955
PER3 <- MSME Performance	0.922	0.922	0.893	0.945
PER4 <- MSME Performance	0.81	0.809	0.744	0.865
QRIS1 <- Adoption of QRIS	0.783	0.782	0.714	0.837
QRIS2 <- Adoption of QRIS	0.601	0.601	0.516	0.678
QRIS3 <- Adoption of QRIS	0.819	0.82	0.767	0.861
QRIS4 <- Adoption of QRIS	0.740	0.738	0.659	0.801
QRIS5 <- Adoption of QRIS	0.681	0.681	0.594	0.752
TE1 <- Ease of Use	0.895	0.896	0.861	0.925
TE1 <- Technological Factor	0.726	0.726	0.654	0.788
TE2 <- Ease of Use	0.883	0.883	0.838	0.920
TE2 <- Technological Factor	0.690	0.689	0.602	0.766
TE4 <- Security	0.815	0.816	0.766	0.864
TE4 <- Technological Factor	0.772	0.773	0.719	0.825
TE5 <- Security	0.806	0.805	0.739	0.856
TE5 <- Technological Factor	0.718	0.717	0.637	0.787
TE6 <- Security	0.853	0.853	0.808	0.89
TE6 <- Technological Factor	0.767	0.768	0.702	0.823
TE7 <- Security	0.683	0.681	0.587	0.763

TE7 <- Technological Factor	0.639	0.638	0.538	0.723
TE8 <- Relative Advantage	0.883	0.882	0.837	0.917
TE8 <- Technological Factor	0.698	0.699	0.612	0.776
TE9 <- Relative Advantage	0.906	0.907	0.882	0.928
TE9 <- Technological Factor	0.775	0.775	0.718	0.825