

QRIS, Digital Wallets, and Changes in Transaction Patterns of Indonesian People

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ABSTRACT

This article discusses the role of QRIS and digital wallets in changing the transaction patterns of Indonesian people. The methods used were literature studies and secondary data analysis from Bank Indonesia, APJII, e-Conomy SEA, BIS, World Bank, OECD, and mobile payment literature. The results of the study show that QRIS functions as a payment standardization infrastructure that expands interoperability, lowers merchant barriers, and accelerates the digitalization of MSMEs. Until the first semester of 2025, QRIS will reach 57 million users, 39.3 million merchants, and record 6.05 billion transactions worth IDR 579 trillion. The change in transaction patterns is seen in the increasing preference for fast, practical, and integrated payments. However, this transformation also poses security risks, privacy, fraud, and impulsive consumption. Novelty article is a digital transaction behavior framework that connects consumer convenience, merchant inclusion, and risk governance. The article recommends digital financial literacy, strengthening security, and consumer protection.

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1. INTRODUCTION

QRIS, digital wallets, mobile banking, and digital payment channels have changed the way Indonesians make transactions. If previously cash payments were the main habit in stalls, markets, transportation, and micro businesses, now transactions can be completed by scanning QR codes, using digital wallet balances, or withdrawing funds directly from the account. These changes show that the transformation of the digital economy is not only happening in the way people buy goods, but also in the way value is moved, recorded, and trusted [1]-[6].

Bank Indonesia defines QRIS as a national payment QR Code standard used to facilitate payment transactions in Indonesia. QRIS was developed with the payment system industry to make QR transactions fast, easy, cheap, safe, and reliable. BI also emphasized that QRIS can be an entry point for MSMEs into the digital ecosystem and facilitate various instruments and sources of payment funds [1]. Until the first semester of 2025, QRIS will reach 57 million users and 39.3 million merchants, with 93.16% of merchants being MSMEs, and recorded 6.05 billion transactions worth IDR 579 trillion [6]. Previous research provides the basis for understanding the adoption of digital payments. Dahlberg et al. reviewed mobile payment research and emphasized the importance of the ecosystem of actors, security, and user value [7]. Oliveira et al. show that the adoption of mobile payments is influenced by performance expectations, convenience, security, innovation, and social recommendations [8]. Gomber et al. put digital payments as part of a fintech transformation that is transforming financial business models [9]. Auer et al. discuss how digital payment technology and central bank innovation are impacting payment system architectures [10]. BIS emphasizes that digital payments can expand financial inclusion if they are designed with access, affordability, and consumer protection [11] in mind.

In Indonesia, QRIS has an interesting character because it simplifies the fragmentation of various payment providers. A single QR code can accept payments from multiple applications, so merchants don't need to provide many different codes. For consumers, QRIS lowers transaction barriers because payments can be made with existing applications. For regulators, QR standardization helps the interoperability and supervision of payment systems. This innovation is important for MSMEs, especially small businesses that previously found it difficult to accept non-cash payments due to equipment costs, administration, and limited technology literacy. Changes in transaction patterns are not only related to efficiency. Digital payments are changing the habit of recording expenses, the way merchants manage cash flow, financing access opportunities, and the economic data footprint. Transactions that were not previously formally recorded can be useful data for business analysis, credit scoring, and financial services integration. However, transaction data also poses privacy risks, fraud, phishing, QR manipulation, and reliance on networks and application systems. For the public, digital wallets and QRIS are forming a new transaction culture. Payments are faster and more hygienic, but they can also make expenses feel less noticeable than cash. In cash, consumers see money reduced physically. In digital payments, spending occurs through numbers on the screen. This psychological change is important for financial literacy, especially for the younger generation and users who are new to the digital financial system.

The novelty of this article is a framework of digital transaction behavior that connects three dimensions: consumer convenience, merchant inclusion, and risk governance. This article positions QRIS and digital wallets as a habit change infrastructure, not just a means of payment. With this framework, the article explains

how digital payments are changing the transaction patterns of Indonesian people while creating new needs in literacy, security, and consumer protection.

2. METHOD

This study uses literature study methods and secondary data analysis. The main data is sourced from Bank Indonesia, APJII, the e-Conomy SEA report, the World Bank, BIS, OECD, and academic literature on mobile payments and fintech. The focus of the analysis is directed at indicators of users, merchants, transaction volume, transaction value, and digital payment adoption factors [1]-[25]. The research stages include the identification of official data, the extraction of QRIS indicators, the grouping of factors for change in transaction behavior, and the synthesis of policy implications. Behavioral factors are grouped into five categories: convenience, speed, security, cost, and social acceptance. Meanwhile, policy implications are grouped into merchant inclusion, consumer literacy, risk governance, and payment system interoperability. Visualizations are compiled from publicly available aggregated data. The article does not use users' personal data or individual transaction data. The main limitation is the absence of a primary survey that directly measures the psychological motivation of QRIS users, so the interpretation of behavior is based on a synthesis of literature and macro indicators.

3. RESULTS AND DISCUSSION

3.1. QRIS as a Standard Payment Infrastructure

The results of the study show that QRIS plays a role as a standardization infrastructure. Before standardization, merchants could potentially encounter multiple QR codes from various payment providers. QRIS simplifies this through a single standard that can be used across providers. This standardization lowers coordination costs and expands digital payment acceptance, especially for MSMEs that do not have large technological capacity [1], [2], [6]. With 39.3 million merchants and 93.16% of them MSMEs, QRIS is a significant channel for digitizing micro businesses. For small merchants, the main benefit is not only accepting cashless payments, but also obtaining transaction records, reducing the need for change, and speeding up queues. In the long run, a digital transaction footprint can help businesses build a more credible financial profile.

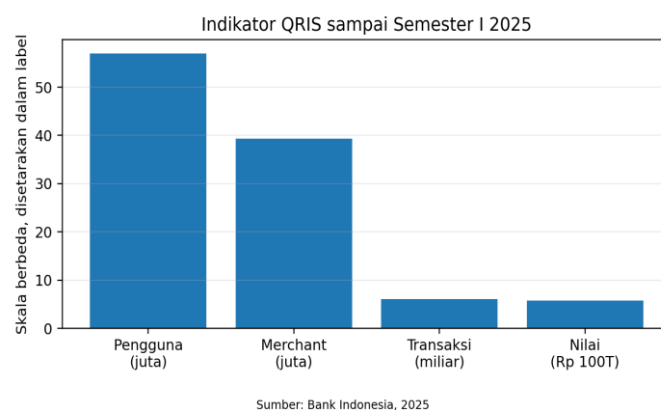
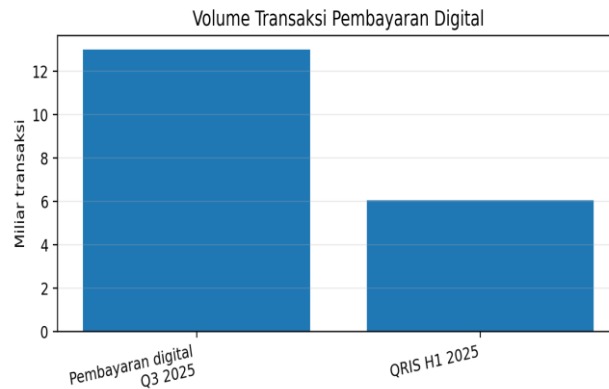


Figure 1. QRIS indicator until the first semester of 2025.

3.2. Changes in Consumer Transaction Patterns

Changes in consumer transaction patterns can be seen in the increasing preference for fast, practical, and integrated payments with everyday applications. Consumers no

longer carry large amounts of cash, but rely on digital wallet or account balances. Payments are part of a broader digital experience, including online shopping, transportation, food delivery, donations, bill payments, and in-store transactions. However, the ease of transactions can also affect spending controls. Digital payments reduce psychological friction because consumers don't see physical money changing hands. Therefore, digital financial literacy needs to include the ability to read transaction history, set spending limits, verify merchants, and understand service fees. Without such literacy, convenience can turn into impulsive consumption or vulnerability to fraud.



Sumber: Bank Indonesia, 2025

Figure 2. Comparison of digital payment transaction volume and QRIS based on BI data.

3.3. Digital Wallets, Marketplaces, and Payment Ecosystems

Digital wallets and QRIS are growing along with marketplaces, transportation services, and mobile banking. The integration creates a mutually reinforcing payments ecosystem. Consumers who are used to paying in the marketplace tend to find it easier to receive QRIS in physical stores. On the other hand, merchants who accept QRIS are easier to enter other digital channels because they already have a non-cash payment experience. This ecosystem expands inclusion, but it also increases reliance on digital infrastructure. Network disruptions, application errors, or cyberattacks can hinder transactions. Therefore, digital payment systems must be seen as public infrastructure that requires security, redundancy, education, and complaint handling mechanisms.

3.4. Security and Consumer Protection Risks

Digital payment risks include phishing, social engineering, fake QRs, account takeovers, data leaks, and transfer errors. These risks are often not only technical, but also behavioral. Users can be deceived by being in a hurry, not checking the merchant's name, or sharing OTP codes. Therefore, consumer protection must combine strengthening the system with safe behavior education. Bank Indonesia and payment service providers need to continue to strengthen security standards, suspicious transaction monitoring, public education, and incident response obligations. Merchants also need to be trained to maintain QR displays, update business data, and help consumers verify payments. Trust is the primary capital of digital payments; Once trust declines, adoption can be disrupted even though technology is already available.

3.5. Relevance of Results to Relevant Research

The findings of this article are consistent with Dahlberg et al. that mobile payments should be understood as an ecosystem, not a single application [7]. The results are also in line with Oliveira et al. who emphasized convenience, security, and social influence in the adoption of mobile payments [8]. Gomber et al. show that fintech is changing the

structure of financial services, while the context of QRIS Indonesia shows how regulatory standardization can accelerate merchant inclusion [9]. With BI data on users, merchants, volume, and transaction value, this article reinforces BIS's argument that digital payments can support inclusion if costs are low, easy access, and consumer protections are adequate [11].

The contribution of this article is to combine the perspective of consumer behavior and payment system governance. QRIS not only changes the way people pay, but also changes the way people record, trust, and manage transactions.

Table 2. Changes in people's transaction patterns due to digital payments

Behavioral dimensions	Before digital payments	After QRIS/digital wallet	Implications
Speed	Waiting for change	Scan and confirmation	Shorter queues
Spend control	Physical money is visible	Recorded digital history	Need Literacy to Read Transactions
Trust	Face-to-face and cash	Merchant name validation and notifications	The Need for Security Education
Merchant access	limited EDC tools	QR is easy to install	MSMEs are more inclusive
Economic data	Many transactions are not recorded	Digital transaction footprint	Financing and analytics potential

Source: compiled by the author.

3.7. Practical Implications and Critical Reflection

The practical implication of QRIS for MSMEs is a change in cash management. Digital transactions reduce the need for change and improve recordkeeping, but merchants must understand settlement times, service fees, and how to match payment notifications. Simple training on transaction reconciliation can increase the benefits of QRIS for small businesses.

For consumers, QRIS increases convenience but also demands safe habits. Consumers should check the merchant's name before pressing pay, not sharing OTPs, using the app key, and monitoring transaction history. This literacy needs to be taught in simple language because QRIS users come from various ages and educational backgrounds. In terms of policy, the expansion of QRIS in rural areas must pay attention to internet quality, smartphone ownership, and merchant readiness. Without adequate infrastructure, digital payments can become unstable and lower trust. Therefore, network expansion and local education must go hand in hand. Payment service providers need to develop a user-friendly interface design. A lot of transaction risks occur not because users don't care, but because the app's display is confusing or security warnings are unclear. A good design should help users make safe decisions in no time. In the long term, digital transaction data can support financing inclusion. Merchants that consistently accept digital payments have a cash flow history that can be used for financing feasibility analysis. However, the use of such data must comply with the principles of consent, privacy, and transparency so as not to harm small business actors.

3.8. Advanced Analysis: Scenarios, Indicators, and Implementation Strategies

The high growth scenario in transaction changes through QRIS and digital wallets illustrates the conditions when digital infrastructure, user trust, and business readiness grow simultaneously. In this scenario, the actors involved include users, MSME

merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The uneven growth scenario on transaction changes through QRIS and digital wallets illustrates conditions when adoption is concentrated in urban areas, large enterprises, or higher-educated users. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The consumer protection scenario for changes in transactions through QRIS and digital wallets illustrates conditions when technological innovation is accompanied by complaint mechanisms, security standards, and information transparency. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The cost efficiency scenario in transaction changes through QRIS and digital wallets illustrates the condition when business actors use technology to reduce operational costs without reducing service quality. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and

cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The scenario of a platform's reliance on changing transactions through QRIS and digital wallets illustrates a condition when small actors are overly dependent on the rules, fees, and algorithms of large digital actors. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The low literacy scenario on transaction changes through QRIS and digital wallets illustrates the conditions when users adopt technology due to promotion, but do not yet understand the risks, rights, and obligations. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The data governance scenario on transaction changes through QRIS and digital wallets describes the conditions when transaction and behavioral data become an economic asset as well as a source of privacy risk. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast,

recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The MSME inclusion scenario in transaction changes through QRIS and digital wallets illustrates the conditions when technology opens market access, recording, payment, and financing for small businesses. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The adaptive regulatory scenario on changes in transactions through QRIS and digital wallets illustrates the conditions when the government makes clear rules but still provides room for experimentation for innovation. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The system resilience scenario on transaction changes through QRIS and digital wallets describes the conditions when the ecosystem is able to stay running in the event of network disruptions, market changes, or security risks. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not

to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The educational collaboration scenario on transaction changes through QRIS and digital wallets illustrates the conditions when universities, industry, and the government provide curricula that are relevant to digital needs. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The ethical and accountability scenarios for transaction changes through QRIS and digital wallets illustrate the conditions when technology-based decisions can be explained, audited, and accounted for. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The regional competitiveness scenario on the change in transactions through QRIS and digital wallets illustrates the conditions when regions are not only users, but also producers of value in the digital economy. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the

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The channel integration scenario in transaction changes through QRIS and digital wallets describes the condition when physical and digital channels complement each other in one user journey. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The continuous learning scenario on transaction changes through QRIS and digital wallets describes the conditions when users and business actors continue to adjust behavior based on experience and data. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The reputation risk scenario on changes in transactions through QRIS and digital wallets describes conditions when a single incident of service, security, or misinformation can lower the trust of the ecosystem. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the

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The scenario of measuring the impact on transaction changes through QRIS and digital wallets illustrates the conditions when success is not only calculated from transaction volume, but also from the quality of socio-economic benefits. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

The sustainability scenario on transaction changes through QRIS and digital wallets illustrates the conditions when digital growth considers worker welfare, consumer protection, and resource efficiency. In this scenario, the actors involved include users, MSME merchants, PJPs, banks, digital wallets, Bank Indonesia, and cybersecurity providers. The key issue is the shift in payments from cash to fast, recorded, and interoperable transactions across applications. In order for the benefits not to stop at increasing adoption rates, the analysis needs to pay attention to the quality of the process, the distribution of benefits, and the ability of users to understand the consequences of digital decisions. Risks to anticipate include fake QRs, phishing, system disruptions, overspending, low security literacy, and internet access gaps. Therefore, relevant strategies are transaction security education, QR standards, consumer protection, infrastructure expansion, and user-friendly application design. Indicators that can be monitored include the number of users, number of merchants, transaction volume, transaction value, fraud cases, settlement time, and merchant satisfaction level. This approach helps research move from trend descriptions to more responsible impact evaluation.

3.9. Findings Operationalization Matrix

Table 3. Operationalization of advanced analytics dimensions

Dimensions	Operational definition	Indicator	Measurement source
Adoption	How far the technology is used by the target actor	Number of active users, intensity of use, variety of features utilized	User surveys, platform aggregate data, regulator reports
Trust	a level of confidence that the system is safe, fair, and reliable	Complaint Rate, Successful Dispute Resolution, Perception of Security	Perception surveys, complaint data, service audits
Efficiency	Changes in time costs, transaction fees, and administrative fees	Turnaround time, service fee, productivity per transaction	Process observations, operational reports, case studies
Inclusions	the ability of small or vulnerable groups to benefit	participation of MSMEs, rural areas, new users, access to financing	administrative data, MSME surveys, regional mapping
Risks	possible financial, data, reputational, or social loss	cases of fraud, data leakage, misdecisions, user churn	Incident reports, security data, actor interviews
Justice	Distribution of costs and benefits between actors	Margin changes, training access, compliance costs, bargaining positions	Policy analysis, business actor surveys, price data
Sustainability	the ability of the system to survive without harming small actors	User retention, business health, service stability, regulatory adaptation	Data panel, longitudinal studies, program evaluation

3.10. Policy Agenda and Applied Research

The agenda for the Government is to provide adaptive regulations, public data, user protection guidelines, and a safe innovation test room. In the context of changing transactions through QRIS and digital wallets, this role cannot be carried out in isolation because the digital economy is an ecosystem. The success of one actor depends heavily on the readiness of other actors. For example, industrial innovation requires regulatory certainty, while good regulation requires empirical data and feedback from users. Therefore, collaboration between institutions is a prerequisite for digital transformation to produce broad and accountable benefits.

The agenda for universities is to develop a digital economy curriculum, data laboratories, policy-based research, and service to MSMEs. In the context of changing transactions through QRIS and digital wallets, this role cannot be carried out in isolation because the digital economy is an ecosystem. The success of one actor depends heavily on the readiness of other actors. For example, industrial innovation requires regulatory certainty, while good regulation requires empirical data and feedback from users.

Therefore, collaboration between institutions is a prerequisite for digital transformation to produce broad and accountable benefits.

The agenda for the industry is to increase service transparency, user-friendly design, risk audits, and partner capacity building programs. In the context of changing transactions through QRIS and digital wallets, this role cannot be carried out in isolation because the digital economy is an ecosystem. The success of one actor depends heavily on the readiness of other actors. For example, industrial innovation requires regulatory certainty, while good regulation requires empirical data and feedback from users. Therefore, collaboration between institutions is a prerequisite for digital transformation to produce broad and accountable benefits.

The agenda for MSMEs is to build a digital identity, record transactions, reputation management, and product differentiation strategies. In the context of changing transactions through QRIS and digital wallets, this role cannot be carried out in isolation because the digital economy is an ecosystem. The success of one actor depends heavily on the readiness of other actors. For example, industrial innovation requires regulatory certainty, while good regulation requires empirical data and feedback from users. Therefore, collaboration between institutions is a prerequisite for digital transformation to produce broad and accountable benefits. The agenda for consumers is to improve risk literacy, the ability to check information, and the discipline in making digital decisions. In the context of changing transactions through QRIS and digital wallets, this role cannot be carried out in isolation because the digital economy is an ecosystem. The success of one actor depends heavily on the readiness of other actors. For example, industrial innovation requires regulatory certainty, while good regulation requires empirical data and feedback from users. Therefore, collaboration between institutions is a prerequisite for digital transformation to produce broad and accountable benefits. The agenda for local communities is to bridge the needs of the community with digital solutions that are in accordance with the language, culture, and character of the region. In the context of changing transactions through QRIS and digital wallets, this role cannot be carried out in isolation because the digital economy is an ecosystem. The success of one actor depends heavily on the readiness of other actors. For example, industrial innovation requires regulatory certainty, while good regulation requires empirical data and feedback from users. Therefore, collaboration between institutions is a prerequisite for digital transformation to produce broad and accountable benefits. The agenda for technical regulators is to develop standards for interoperability, security, reporting, and audit mechanisms that do not burden small actors. In the context of changing transactions through QRIS and digital wallets, this role cannot be carried out in isolation because the digital economy is an ecosystem. The success of one actor depends heavily on the readiness of other actors. For example, industrial innovation requires regulatory certainty, while good regulation requires empirical data and feedback from users. Therefore, collaboration between institutions is a prerequisite for digital transformation to produce broad and accountable benefits.

Table 4. Collaborative agenda based on ecosystem actors

Actors	Strategic role	Forms of intervention	Expected output
Government	Provide adaptive regulation, public data, user protection guidelines, and a secure innovation test room	programs, regulations, training, audits, or mentoring	An ecosystem that is more inclusive, safe, and productive
Colleges	developing digital economy curriculum, data laboratories, policy-based research, and service to MSMEs	programs, regulations, training, audits, or mentoring	An ecosystem that is more inclusive, safe, and productive
Industry	Improved service transparency, user-friendly design, risk audits, and partner capacity building programs	programs, regulations, training, audits, or mentoring	An ecosystem that is more inclusive, safe, and productive
MSMEs	Build digital identity, transaction logging, reputation management, and product differentiation strategies	programs, regulations, training, audits, or mentoring	An ecosystem that is more inclusive, safe, and productive
Consumers	Improve risk literacy, information checking ability, and discipline in digital decision-making	programs, regulations, training, audits, or mentoring	An ecosystem that is more inclusive, safe, and productive
Local communities	Bridging the needs of the community with digital solutions that are appropriate to the language, culture, and character of the region	programs, regulations, training, audits, or mentoring	An ecosystem that is more inclusive, safe, and productive
Technical regulator	Develop standards for interoperability, security, reporting, and audit mechanisms that do not burden small actors	programs, regulations, training, audits, or mentoring	An ecosystem that is more inclusive, safe, and productive

3.11. Limitations of Analysis and Anticipation of Bias

The first limitation is the use of aggregate data. Aggregate data is useful for seeing the scale and direction of change, but it is not yet able to explain variations in individual behavior. Differences in income, education, region, age, and digital experience can result in patterns that differ from the national average. Therefore, the results of this article need to be read as a macro synthesis that requires microtesting. The second limitation is the potential for bias in industry report sources. Industry reports often have rich data, but

they can also carry certain narrative interests. To reduce bias, this article combines industry reports with government data, regulatory publications, and academic literature. This triangulation does not eliminate all bias, but reinforces the prudence of interpretation. The third limitation is the dynamics of the digital economy which is very fast. User numbers, transactions, regulations, and technology can change in a short period of time. Therefore, this kind of article needs to be updated regularly. Claims that are quantitative should always be accompanied by data years, sources, and interpretation limitations. The fourth limitation has to do with the concept of success. Many digital analytics focus too much on the number of users or the value of transactions. In fact, more substantive successes include service quality, security, equitable distribution of benefits, strengthening small actors, and consumer protection. This article attempts to expand on the indicator, but its measurement still requires further research. The fifth limitation is the absence of causal modeling. The relationship between technology and behavioral change is not always one-way. Technology influences behavior, but people's behavior also shapes technological features. Follow-up studies can use panel models, field experiments, or mixed methods to test the mechanism more robustly.

Table 5. Potential bias and analysis mitigation strategies

Potential bias	Impact on interpretation	How to mitigate
Aggregate data	hide individual and regional variations	Use microsurveys and spatial analysis
Industry reports	narrative can be overly optimistic	Triangulation with regulatory and academic data
Quick changes	numbers can become obsolete	Enter the year and update the data
Focus volume	Ignoring the quality of the benefits	Add safety, inclusion, and satisfaction indicators
Without causality	The relationship is only descriptive	Continue with empirical models and mixed methods

3.12. Integrative Narrative for Research Model Development

Advanced research models can be built by placing individual, organizational, and institutional factors as interacting variables. Individual factors include literacy, experience, risk perception, and trust. Organizational factors include technology capacity, service quality, and data management capabilities. Institutional factors include regulations, public infrastructure, and social norms. With this structure, the analysis does not stop at the simple relationship between technology and behavior, but looks at how technology works through a specific socio-economic environment.

Quantitative approaches can use structural equation models to test the relationship between convenience, usability, trust, risk, and intent of use. However, the model needs to be equipped with Indonesian contextual variables, such as community strength, promotional role, family influence, fraud experience, and the quality of regional infrastructure. Without contextual variables, digital adoption models tend to be too general and lack a grasp of the diversity of people's behaviors. A qualitative approach remains important because many digital decisions are influenced by reasons that are not always reflected in numbers. In-depth interviews can delve into how businesses understand the benefits and risks, how consumers interpret security, and

how regulators see the line between innovation and protection. Narrative data like this is useful to explain why two groups with the same access to technology might exhibit different behaviors.

The blended method is a strong choice for this topic. Surveys can provide an overview of general patterns, while interviews and case studies can shed light on the mechanisms behind those patterns. For example, survey data can show that trust influences adoption, but interviews can shed light on the source of that trust: personal experiences, family recommendations, platform reputation, or previous problem-solving success. Spatial analysis is also relevant because Indonesia's digital economy is unevenly distributed between regions. Regions with strong internet infrastructure, high merchant density, and good digital literacy will experience faster transformation. In contrast, regions with limited access may experience slower adoption or use only basic features. Therefore, regional maps, digital readiness indices, and local transaction data can enrich subsequent research. Policy evaluations should look not only at administrative outputs, but also at the real impact on users. Digitalization programs often succeed in increasing the number of accounts, merchants, or transactions, but not necessarily in increasing profits, well-being, or security. Impact evaluation needs to distinguish between outputs, outcomes, and impacts. Output is the number of participants or transactions; Outcome is a change in ability; Impact is a change in well-being and sustainability. In the development of theory, the Indonesian context can contribute to the global digital economy literature because it has a combination of large markets, high internet penetration, dominant MSMEs, archipelago areas, and social diversity. This combination makes Indonesia an important laboratory for understanding how digital technology operates in heterogeneous developing countries. Indonesia's findings can expand theories that have been based on developed countries.

In practical terms, advanced research needs to produce instruments that are easy for policymakers to use. Readiness indices, risk dashboards, literacy matrices, and simple audit guidelines can help public institutions and business actors make decisions. Academic articles would be more useful if they could be translated into work tools that improve policies and practices in the field. The development of indicators must pay attention to the balance between efficiency and fairness. Efficiency indicators such as transaction volume, processing time, and service costs need to be paired with fairness indicators such as small group access, cost burden, risk of loss, and ability to file complaints. This balance prevents digital transformation from being judged only by growth, when the quality of growth is just as important. Finally, the entire analysis needs to keep in mind that technology is a tool, not an end. The main goals of the digital economy are to improve welfare, expand opportunities, strengthen competitiveness, and improve service quality. As technology begins to create new risks, research and policy must be able to correct course. Thus, digital transformation can be a humane, inclusive, and sustainable process.

3.13. Stage-Based Implementation Recommendations

The first stage is needs mapping. Each actor needs to understand the problem they want to solve before choosing a digital solution. This mapping includes the slowest processes, the most frequent emerging risks, the most vulnerable user groups, and available data sources. Without mapping, digital transformation can turn into the use of directionless technology.

The second stage is the preparation of minimum standards. Minimum standards are necessary so that innovation does not come at the expense of safety, fairness, and

affordability. These standards can be in the form of verification procedures, information quality, limits of responsibility, data protection, and complaint mechanisms. Minimum standards don't have to be complicated, but they should be clear and easy to understand. The third stage is the training of key actors. Training should not only be in the form of one-way socialization, but case-based assistance. Users need to practice dealing with real scenarios such as failed transactions, unclear information, consumer complaints, fraud, regulatory changes, or the use of new features. A practical approach is more effective to improve digital readiness. The fourth phase is a limited pilot project. Before a policy or feature is widely implemented, small-group trials can help identify technical and social issues. Pilot projects can also measure implementation costs, support needs, user responses, and unforeseen risks. The results of the trial should be published concisely so that it can be a joint learning. The fifth stage is data integration and periodic evaluation. The data generated by the digital system must be processed into policy information, not just stored. Periodic evaluations can help see if goals are being achieved, who is benefiting, who is falling behind, and what risks are increasing. This evaluation is the basis for improving regulations and service design. The sixth stage is the strengthening of the correction mechanism. In a digital ecosystem, mistakes can happen very quickly and have a far-reaching impact. Therefore, every policy and service should have an easily accessible remediation path. Users need to know who to report to, how long the response should take, and what evidence is needed. The correction mechanism is an important part of trust. The seventh stage is the development of regional collaboration. Many digital issues emerge locally, such as market trader literacy, network quality, communication language, and transaction habits. Local governments, campuses, communities, and local business actors can be the link between national policies and community needs. Regional collaboration makes digital transformation more grounded. The eighth stage is the preparation of long-term impact indicators. Short-term indicators such as the number of users are important, but not enough. Long-term indicators need to assess increased revenue, business efficiency, user safety, compliance, access to financing, and quality of service. With indicators like this, digital transformation can be evaluated in terms of welfare, not just activities. The ninth stage is adaptive regulatory reform. Digital regulations should not be too slow, but they should also not change too often so as to confuse business actors. Public consultation mechanisms, regulatory sandboxes, and regulatory impact evaluations can help maintain a balance between legal certainty and innovation flexibility. The tenth stage is the formation of a responsible digital culture. This culture includes the habit of checking information, respecting personal data, reporting problems, using technology for productivity, and avoiding manipulative practices. Digital culture is not formed only through applications, but through education, institutional examples, and a secure user experience.

3.14. Academic Implications for the Development of the Digital Economy Curriculum

This topic also has academic implications for the development of the digital economy curriculum. It is not enough for students to understand the definition of technology, but they need to be able to read the relationship between data, behavior, regulation, and business strategy. A good curriculum needs to combine economic theory, statistics, data ethics, information systems, and public policy. Learning can be directed to Indonesian case studies so that students see real complexities. The case of marketplaces, AI, digital taxes, QRIS, MSMEs, and consumer protection can be used as material for data-based discussions. Thus, students learn that digital transformation is not only a problem of application, but also a problem of institutions and behavior.

Analytical skills need to be strengthened through the practice of reading official reports, assessing the validity of sources, making simple visualizations, and drafting policy recommendations. This skill is important because many digital economy decisions are made based on ever-changing data. Students need to be trained to be critical of numbers, not just quote them. The curriculum should also include community-based projects. Students can assist MSMEs, traditional markets, schools, or local communities in understanding digital technology. Projects like this bring together theory and practice and help campuses play a role in an inclusive digital transformation. From the research side, universities can build secondary data repositories and survey instruments that can be used across topics. Standardization of instruments facilitates comparisons between time and between regions. With more consistent data, Indonesia's digital economy research can evolve from descriptive writing to stronger empirical analysis. The final implication is the need for digital research ethics. Researchers should be careful in using transaction data, user data, and platform data. The principles of data minimization, anonymization, consent, and storage security should be part of academic training. Without ethics, digital economy research can pose a risk to the subjects it wants to protect.

4. CONCLUSION

QRIS and digital wallets have changed the transaction patterns of the Indonesian people from cash payments to fast, interoperable, and recorded payments. QRIS plays an important role because it unites various payment instruments in one QR standard, thereby lowering barriers for consumers and merchants. BI data shows a large scale of adoption, especially in MSMEs. The main benefits of digital payments include efficiency, inclusion, transaction recording, and financial service access opportunities. However, security, privacy, fake QRs, fraud, and impulsive consumption risks need to be managed through literacy, security standards, surveillance, and responsive complaint mechanisms. The success of QRIS is not only determined by the number of transactions, but also by the level of public trust. The next study is recommended to conduct a primary survey to measure the psychological factors of QRIS adoption. The next study needs to compare the use of QRIS in urban and rural areas. Advanced research can also test the influence of digital payments on financial recording and MSME financing access.

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Authors state no conflict of interest.

Informed Consent

Not applicable because this study uses secondary data and published literature without collecting personal data from human participants.

Ethical Approval

Not applicable because this study does not involve experiments with humans or animals.

Ethical Approval

Not applicable because this study does not involve experiments with humans or animals.

Data Availability

The data supporting the findings of this study are available in the public reports and official publications listed in the References section. Derived data supporting figures and tables are available within the article.

Declaration of Generative AI and AI-assisted Technologies

Generative AI tools were used to improve drafting, language consistency, and formatting. The analysis framework, source selection, tables, figures, and conclusions must be reviewed and validated by the author before submission.

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