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Analysis of National QR Code Payment Systems: Practices in 3 Developing Countries (Indonesia, Nigeria, and India)

Andi Asrihapsari[1]*
Ika Swasti Putri[2]
Arinze E. Anaege[3]
[1]Diploma 3 in Accounting, Vocational School, Universitas Sebelas Maret, Surakarta, Indonesia
[2]Accounting Department, Faculty of Economics and Business, Universitas Negeri Surabaya, Magetan, Indonesia
[3]Accounting Department, Faculty of Social and Management Sciences, Kingsley Ozumba Mbadiwe University, Ideato, Imo State, Nigeria
*Corresponding author: andiasrihapsari@staff.uns.ac.id

ABSTRACT

This study explores the payment system practices using national quick response codes (QR codes) in three developing countries—Indonesia, India, and Nigeria—which are members of the World Trade Organization (WTO). Using a systematic literature review (SLR) approach guided by the PRISMA 2020 protocol, this study analyzed 15 peer-reviewed articles to examine the implementation of QR code-based payment systems. Specifically, the review evaluated trends in national policy practices, geographical focus, research methodologies, journal classifications, and theoretical frameworks employed. Although the study adopted a qualitative SLR methodology, it drew analytical insights from the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). A key finding reveals that national QR code payment systems have been implemented in Indonesia (QRIS), India (BharatQR), and Nigeria (NQR). The goal of implementing national QR code systems is to support financial inclusion, transaction efficiency, and the transition to a cashless society. This study identifies a research gap related to security issues, data privacy, and the macroeconomic impact of QR code payments. This study provides direction for future studies by recommending a mixed-methods approach, cross-cultural exploration, and review of national policies as part of developing an inclusive and sustainable digital payment system.

Keywords: digital financial inclusion; national QR code payment systems; QRIS–BharatQR–NQR; systematic literature review (SLR); technology acceptance models (TAM, UTAUT)

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INTRODUCTION

Globalization in the digital era creates a more open and interconnected global market, stimulating international trade, investment, and knowledge exchange (Kyove et al., 2021). Alkharafi and Alsabah (2025) noted that this has an impact on the trading sector related to transaction efficiency and expanding market access. Bank Indonesia (BI) continues to encourage the digitalization policy of the payment system to lead economic growth. BI reported that there is a payment system that experienced very significant transaction growth, namely the Quick Response Code Indonesian Standard (QRIS). It has a growing transaction of 194.06% annually (YoY) as of April 2024. At the same time, QRIS has 48.9 million users and 31.86 million merchants (Rachman, 2024). QRIS, as the national QR code payment system in Indonesia, has several important roles, namely to increase transaction efficiency, support the digitalization of trade and investment, and maintain macroeconomic stability by expanding the use of transaction settlement using local currency (Local Currency Settlement or LCS) (Bank Indonesia, 2024).

QRIS is a national QR Code standard set by BI and launched on August 17, 2019. QRIS was created to make the domestic payment transaction process using QR Codes easier, faster, and more secure (Bank Indonesia, 2025a). Bank Indonesia (BI) issued provisions for implementing QRIS through the Regulation of the Board of Governors (*Peraturan Anggota Dewan Gubernur/*PADG) No. 24/1/PADG/2022, which amended Regulation No. 21/18/PADG/2019 on the national QR code payment standard. QRIS features continue to evolve, currently including payment transactions (Bank Indonesia, 2023), transfers, cash withdrawals, cash deposits, and cross-border QR transactions (Bank Indonesia, 2024).

However, not everyone is interested in using QRIS for several reasons, such as not having a bank account, believing that the majority of customers still use cash, and having difficulty using QRIS (Pratama, 2023). This is reinforced by current data that show MSMEs that have transformed digitally are approaching 40 percent (Jones, 2024). Even though QRIS has proud achievements, it still has many challenges that must be faced in the future. Therefore, researchers are curious and motivated to explore research on the national QR code payment system that already exists and is likely to be used in the future.

Casagrande and Dallago (2024) note that globalization makes countries increasingly interconnected and dependent on each other in various aspects such as economy, culture, politics, and technology. To face various challenges in this era of globalization and digitalization, cooperation and exchange of knowledge between countries with a common goal are needed. One way is to join the World Trade Organization (WTO) cooperation which was established in 1995. The WTO is the only international organization that regulates international trade which aims to help producers of goods and services, as well as exporters and importers of a large number of countries in the world in carrying out their trading activities (Ochem & Oyewo, 2015).

There are major similarities among countries of Indonesia, India, and Nigeria. The similarities are being a member of the WTO, having a growing economy, and challenges related to the national QR code payment system. Not only Indonesia, but India has also released a national payment system using a QR Code called BharatQR. Like QRIS, although Bharat QR uses QR codes that are easy to use for payments, its popularity is still relatively low. Likewise, in Nigeria, its economic sector relies heavily on cash payments despite the Central Bank of Nigeria's (CBN) New Quick Response (NQR) initiative to unify the QR Code scheme in 2021 (Obi, 2021). The adoption of QR code payment systems in the Nigerian transport sector remains low despite the introduction of NQR payment solutions (Jiddah et al., 2025).

India has BharatQR. BharatQR is a QR code that provides the world's first interoperable QR code acceptance solution. It is jointly developed by India's major card networks National Payments Corporation of India, Mastercard, Visa, and American Express (Kulkarni et al., 2018). The Indian government through the "Digital India Movement," started in 2017, trying to address the challenges of e-payments, such as QR code payments. The rural infrastructure of India needs to be improved to ensure uninterrupted and continuous access to telecommunication networks. The provision of high-speed internet is necessary for the user of bank accounts and mobile phones to participate in the digital and financial space at the individual level (Malladi et al., 2021; Sharma & Piplani, 2017) Information and Communication Technology (ICT) is progressively providing access and helping to bring them into banking services. In 2022, the Indian National Health Authority introduced the Scan and Share service that leverages mobile technology and QR codes to address the concerns of hospital patients who queue for long registration times due to manual data entry, entry errors, and inadequate staff (Neogi et al., 2025). The growth of the company increases if there is innovation for the wider community in India. The innovation, for example, comes from the National Payments Corporation of India (NPCI). They have been at the forefront of innovation in the Indian financial system. They have also introduced many influential products that aim at using a cashless economy and creating financial inclusion for the community (Baj et al., 2023).

Nigeria still has a low level of electronic payment adoption (Gholami et al., 2010; Igudi, 2017; Jiddah et al., 2025). The country uses information and communication technology (ICT) to stay competitive in the global market. To support this, the Nigerian government introduced a cashless policy. Under this policy, all payments for goods and services, especially in government-related transactions, must be made electronically (Igudi, 2017). People adopt ICT tools like mobile money for different reasons across countries. These reasons vary between developed and developing nations (Kelly & Palaniappan, 2022). In Nigeria, awareness of QR code payment systems is relatively high, around 70%. However, actual usage remains low, at only 30% (Jiddah et al., 2025). This shows a gap between awareness and adoption.

Based on the researchers' observations above, this study was conducted to reflect on how existing knowledge has contributed to facing the challenges of the national QR code payment system and determining the future direction that academics should take. Research on QR code payment has been done quite a lot. However, research on the national QR code payment system is limited. This requires further research to obtain effective, efficient, and innovative national QR code payment system practices. The purpose of this study is to review QR code payment research, especially the national QR code payment system, and to provide future direction for researchers. In this context, the researchers aim to answer the following research questions related to national QR code payment system.

1. How is the practice of the national QR code payment system of the three WTO member countries?
2. Where is the geographical distribution of QR code payment research?
3. What methods have been used in QR code payment research?
4. Where is the distribution of journals that publish QR code payment research?
5. What theories have been used in QR code payment research?

RESEARCH METHOD

This study adopted a comprehensive systematic literature review (SLR) methodology. This method is a highly rigorous scientific approach used to identify, evaluate, and synthesize all relevant empirical evidence regarding a predetermined research question. The selection of SLRs is based on the ability to minimize bias through an explicit and systematic process resulting in reliable and replicable findings (Moher et al., 2009). To ensure transparency, rigor, and comprehensive reporting, this review

fully complies with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The use of PRISMA will guide every stage of the review, from literature searches to reporting results, ensuring that the entire process is well-documented and accountable (Page et al., 2021). This methodology is designed to provide an objective and structured overview of the existing literature so that it can produce strong and evidence-based conclusions.

A systematic and extensive literature search strategy was applied to identify relevant studies across leading electronic databases. The main databases used include Scopus as well as specific databases such as Watase UAKE were utilized to optimize the article identification process. It functions as an online research collaboration system that supports systematic literature reviews (Wahyudi et al., 2020). A combination of relevant keywords, synonyms, and Boolean operators (AND, OR) was used in the search. The keyword combination included "QRIS" AND "QR System" OR "QR Payment". The publication date limit was the last 10 years which were applied to ensure the widest possible inclusion of literature. A language filter was applied to limit the results to only articles published in English and Bahasa Indonesia for consistency in data interpretation.

The study selection process was conducted in two main stages to ensure that only the most relevant and high-quality articles were included. In the first stage, two independent reviewers conducted an initial screening based on the title and abstract of all articles identified from the database search. Any potential discrepancies or differences of opinion between reviewers were resolved through discussion and, if necessary, involving a third reviewer to reach a consensus. Articles deemed relevant were then advanced to the second stage, which was full-text screening. Inclusion criteria for this review included primary studies that were peer-reviewed articles, focused on a relevant topic (e.g., the use of PRISMA and Watase UAKE in SLR), and published in a scientific journal. Excluded studies included opinion pieces, editorials, conference abstracts without full-text publication, and studies that did not fit the stated research question. Watase UAKE was used as a tool to manage identified articles, track the screening process, and facilitate collaboration between reviewers at each stage of the selection process (Wahyudi et al., 2020).

Data extraction from the selected studies was carried out systematically using a pre-defined standard data extraction form. The extracted information included, but not limited to, general details of the study (authors, year of publication, country), study objectives, study design, sample size, methodology used, relevant key results, and conclusions. The methodological quality or risk of bias of each included study was independently assessed by two reviewers using appropriate quality assessment instruments, such as the JBI Critical Appraisal Tools for different types of study designs (Moola et al., 2020). Any disagreements during the data extraction or quality assessment process were resolved through discussion or intervention by a third reviewer, to ensure objectivity and consistency of the extracted and assessed data. Following initial screening, 15 articles met the inclusion criteria and proceeded to full-text assessment (Table 1). As shown in Table 1, these 15 articles indicate a successful initial screening result, and the next step is full-text eligibility assessment and data extraction.

Table 1. Result of publication search in Watase UAKE

No.	Information	n	n final
1	Database: Scopus Keyword: QRIS, QR Payment	54	54
2	Not included in Tier Q1, Q2, Q3, and Q4	(7)	46
3	File is off topic	(21)	25
4	File cannot be downloaded	(10)	15

Data analysis and synthesis were conducted narratively, namely by identifying patterns, themes, and relationships between findings from included studies. Due to its heterogeneous nature, quantitative meta-analysis could not be performed; therefore, narrative synthesis provides a comprehensive overview of the available evidence. The results of the synthesis are presented in the form of summary tables, descriptive narratives, and diagrams, including a PRISMA flow diagram showing the number of studies identified, screened, assessed for eligibility, and included in the final review(Page et al., 2021). The PRISMA flow diagram of this study is presented in Figure 1.

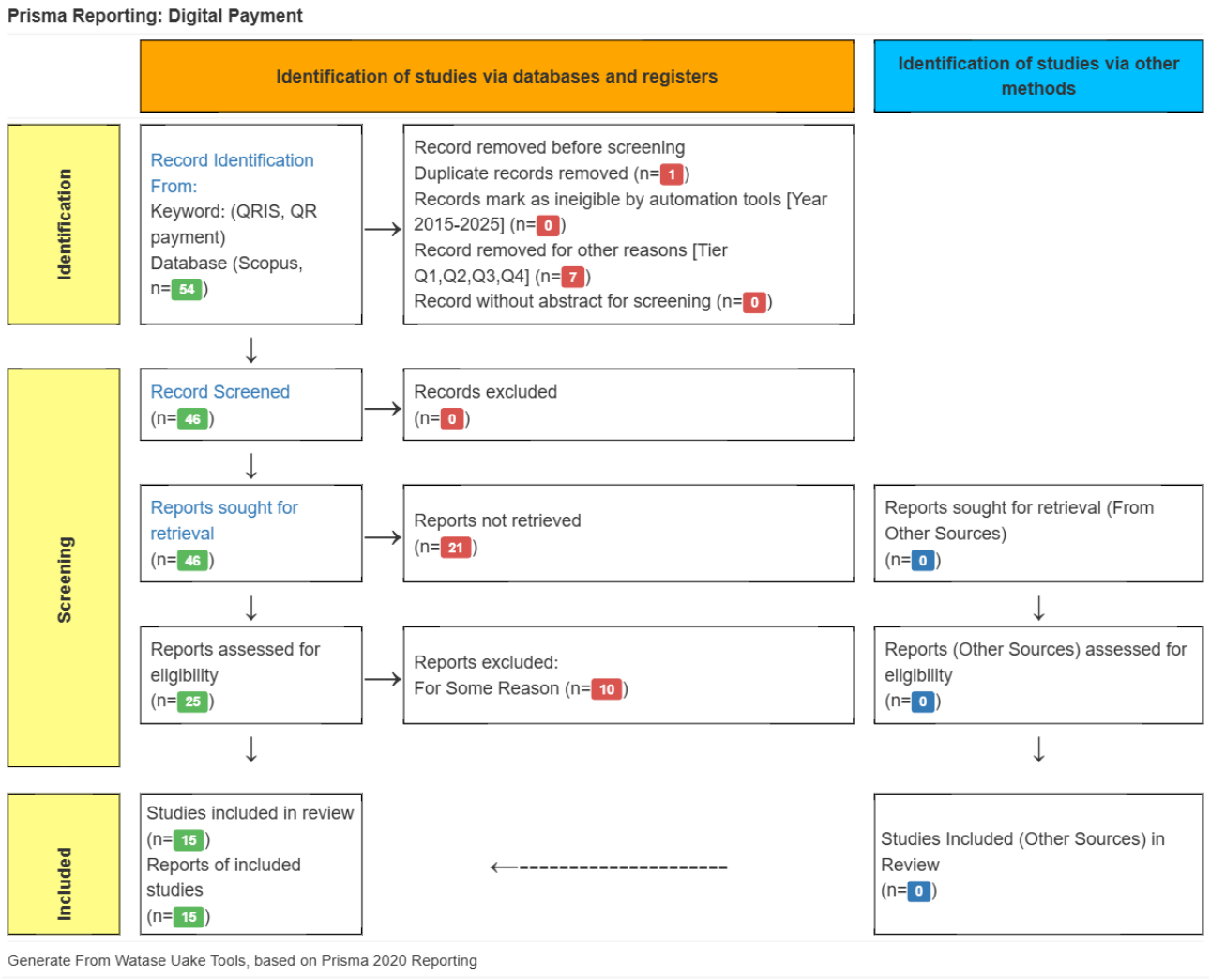

Figure 1. Prisma reporting

In the next section, the researchers analyzed and presented the results, discussion, and conclusions where some future directions for research were presented. The discussion integrated the findings of all included studies, highlighted consistencies and inconsistencies, and identified gaps in the literature. The entire process was reported transparently and in detail according to the PRISMA guidelines, to ensure replication and verification by other researchers.

RESULTS AND DISCUSSION

This research is structured in two main parts: the first part is a comprehensive literature review, followed by the second part which involves data analysis and discussion.

National QR Code Payment System in Practice

The national QR code payment system in Indonesia refers to the Quick Response Code Indonesian Standard (QRIS) which was released in 2019. QRIS is used for QR code payment transactions in various regions in Indonesia. BharatQR is a national QR code payment system in India, similar to QRIS in Indonesia. It is a QR code standard jointly developed by the Reserve Bank of India (RBI) and major card payment companies that was released in India in 2017 with the aim of facilitating the transition to a cashless society. BharatQR was designed to facilitate the transition to a cashless society and facilitate QR code payments. Likewise, in Nigeria, the national QR code payment system is known as the Nigeria Quick Response Code (NQR) which was released in 2021. This is a secure platform used by merchants and customers to make instant payments. Merchants display the NQR Code created to accept payments from payers present at their location. An overview of the national QR code payment systems of the three countries is shown in Table 2.

Indonesia's National QR Code Payment System: Quick Response Code Indonesian Standard (QRIS)

The Quick Response Code Indonesian Standard (QRIS) is a national QR code standard established by Bank Indonesia and launched on August 17, 2019. QRIS was designed to simplify, expedite, and secure domestic payment transactions using QR codes. Starting January 1, 2020, all merchants are required to adopt QR codes that comply with the QRIS standard. To guide the implementation of the QRIS, Bank Indonesia issued the Regulation of the Members of the Board of Governors No. 21/18/PADG/2019 on August 16, 2019. This regulation aims to ensure the smooth implementation of payment services using QRIS in Indonesia. The national adoption of QRIS became effective on January 1, 2020, providing a transition period for Payment System Service Providers.

The use of transactions facilitated by QRIS is on the rise. Additionally, there is an increasing demand for transactions involving amounts exceeding the limits set in previous provisions, such as purchases of artisan products, service transactions (including transportation and tourism), and tax payments. As a response, Bank Indonesia issued Regulation of the Member of the Board of Governors No. 24/1/PADG/2022 on February 25, 2022, which amends Regulation No. 21/18/PADG/2019 concerning the Implementation of the National Standard Quick Response Code for payments. This amendment will take effect on March 1, 2022. QR code transaction fees for merchants: (1) Free: micro business transactions ≤Rp500,000; Public Service Agency (*Badan Layanan Umum*/BLU); Public Service Obligation (PSO); Government to People (G2P): such as Social Assistance (*Bantuan Sosial*/Bansos); People to Government (P2G): such as taxes, passports, and social donations (non-profit); and (2) Charged (Merchant Discount Rate-MDR): micro-business transactions >Rp500,000 (0.3%); gas stations (0.4%); education services (0.6%); small, medium, and large businesses (0.7%).

There are two ways to obtain QRIS: as a Payment Service Provider (PSP) or as a Merchant. Licensed and regulated PSPs by Bank Indonesia that process payment transactions using QRIS must first seek approval from Bank Indonesia. Companies that are not yet licensed as Payment Service Providers can apply for a permit from Bank Indonesia. Merchants interested in accepting QRIS payments should contact a licensed and supervised Payment System Service Provider.

QRIS has two usage models: Merchant Presented Mode (MPM) and Customer Presented Mode (CPM). In Merchant Presented Mode (MPM), the merchant displays the QR code for users to scan. In Customer Presented Mode (CPM), the user displays the QR code for merchants to scan. If there are any issues during payment transactions, users (both individuals and merchants) can file consumer protection complaints with their payment system service providers (Banks and/or Non-Banks) that

issue the payment instruments (such as electronic money, electronic wallets, mobile banking, etc.) they used.

Table 2. Comparison of national QR code payment systems of Indonesia, India, and Nigeria

Information	**Indonesia-QRIS**	**India-BharatQR**	**Nigeria-NQR**
QR code release year	17 August 2019	20 February 2017	16 March 2021
QR code developer	QRIS was developed by the Indonesian Payment System Association (*Asosiasi Sistem Pembayaran Indonesia*/ASPI) together with payment system industry players, supported by Bank Indonesia (BI).	NQR was developed by National Payments Corporation of India (NPCI), Mastercard, and Visa.	NQR was developed and is supported by Nigeria Inter-Bank Settlement System Plc (NIBSS) and Central Bank of Nigeria (CBN).
QR code implementation guidelines	BI issues Regulation No. 24/1/PADG/2022 of the Board of Governors addresses the Second Amendment to Regulation No. 21/18/PADG/2019.	The Reserve Bank of India (RBI), as the central banking institution, sets the overall framework for digital payments, including QR code-based transactions.	CBN issues Circular titled: "Framework for Quick Response (QR) Code Payments in Nigeria."
QR code payment instrument	Electronic money, electronic wallets, mobile banking, etc.	Respective bank mobile banking or any app that supports BharatQR and pay using a Card (via Visa, MasterCard, Amex, or Rupay) or BHIM-UPI.	Mobile banking
QR code usage model	Merchant Presented Mode (MPM), and Customer Presented Mode (CPM)	Merchant Presented Mode (MPM)	Merchant Presented Mode (MPM)
Minimum nominal transaction QR code	Unlimited minimal transaction	Bank dependent (₹2.000)	Minimum determined by the bank
Maximum nominal transaction QR code	limited to a maximum of Rp10,000,000.00 (Ten Million Rupiah) per transaction	Bank dependent (±₹100.000+)	Bank dependent
QR code features	(1) QRIS Payment; (2) QRIS Cross boarder; (3) QRIS TUNTAS (Transfer, cash withdrawal, cash deposit).	Online bill payment	Payment
QR code transaction fees for customers (users)	Free	Free	Free
QR code transaction fees for merchants (Merchant Discount Rate-MDR)	(1) Free: micro business transactions ≤Rp500,000; BLU; PSO; G2P; and Bansos. (2) Charged MDR: micro-business transactions >Rp500,000 (0.3%); gas stations (0.4%); etc.	MDR is same with Point of Sale (POS).	This service charges 1.4% of the transaction value capped at N2000, the same as our local payments in Nigeria.
Reference	(Bank Indonesia, 2025a, 2025b; Hardiantoro & Pratiwi, 2024; PADG No. 21/18/PADG/2019; PADG No. 24/1/PADG/2022; Puspadini, 2024)	(Belgavi, 2017; HDFC Bank, 2025; The Economic Times, 2020; The Federal Bank Limited, 2025; Visa Inc, 2017, 2025)	(Akomolafe-Kalu, 2021; Chima, 2021; NIBSS, 2025; Nwoji, 2022; Okonji, 2021)

Payment instruments that utilize QRIS include debit cards, credit cards, and electronic money that rely on server-based storage media. Each transaction using QRIS is limited to a maximum amount of Rp10,000,000.00 (Ten Million Rupiahs). The issuer has the authority to set daily and/or monthly cumulative transaction limits for each QRIS user, which is determined based on the issuer's risk management strategy. The processing of QRIS transactions involves several parties, including Payment Service Providers (PSP), Switching Institutions, Merchant Aggregators, and managers of the National Merchant Repository. Only Payment System Service Providers within the front-end Payment System Service Provider group, such as Issuers and Acquirers, are able to process QRIS transactions.

QRIS continually develops its features, making it a practical and efficient solution for various financial transactions. In addition to regular payment transactions, QRIS also offers a cross-border feature. The QRIS inter-country system is a cross-border payment solution based on QR codes that can be used for international transactions. In May 2022, Bank Indonesia held a meeting with the governors of five central banks from Indonesia, Thailand, Malaysia, Singapore, and the Philippines to collaborate on showcasing the progress of digital payment system advancements in ASEAN. This system was officially launched on August 29, 2022. With QRIS inter-country, transactions between countries no longer require currency conversion when shopping in a foreign country; users simply scan a QR code. This means that foreign tourists in Indonesia can pay by scanning the QRIS code of Indonesian merchants with their home country's payment application. Similarly, Indonesian tourists can make payments in other countries by scanning the standard QR code of that country using an Indonesian payment application.

The QRIS TUNTAS feature allows users to perform transfers, cash withdrawals, and cash deposits. The QRIS transfer feature enables users to transfer funds to other QRIS users using a QR code, whether between bank Payment Service Providers or between bank and non-bank Payment Service Providers. With the cash withdrawal feature, users can withdraw funds by scanning a QR code at an ATM or a QRIS merchant that acts as an agent or partner for cash withdrawals. One significant advantage of this feature is that users do not need to have a specific bank account to withdraw cash; for example, they can withdraw cash from an electronic money account with a non-bank Payment Service Provider. Furthermore, the QRIS cash deposit functionality allows users to make cash deposits by using a QRIS code. This process uses a push payment method, where the depositor presents their QRIS code to a scanning device at a Cash Deposit Machine (CDM/ATM) or at a QRIS merchant acting as an agent or partner for cash deposits. This feature is especially useful for users who want to deposit cash into a bank (or a non-bank electronic money account) but face constraints due to the distance to an ATM or limited banking hours.

India's National QR Code Payment System: BharatQR

On February 20, 2017, the Reserve Bank of India launched BharatQR, the world's first interoperable and low-cost mobile-based acceptance solution developed in collaboration with the National Payments Corporation of India (NPCI), Mastercard, and Visa. This innovative solution is designed to be scalable, provide a seamless customer experience, and most importantly, ensure safety and security. It plays a critical role in accelerating India’s transition to a cashless society. BharatQR utilizes QR codes—a two-dimensional, machine-readable matrix code used to store information such as text and URLs that can be read by a QR code reader or a mobile phone camera—to facilitate payments to merchants. The solution was developed following the directives issued by RBI in September 2016 under its Payments Vision 2018 initiative. These directives emphasized innovation, interoperability, and security as key pillars for supporting India's move towards a cashless economy. BharatQR offers three key benefits: consumers do not need to scan different QR codes at the same merchant, even if they

are provided by various payment networks; merchants only need to display a single QR code on their storefront or through their acquiring bank's mobile app; and the basic specifications of BharatQR can be implemented in other countries, making it a globally interoperable solution.

QR codes are increasingly being utilized for mobile payments at points of sale, as they can store a considerable amount of information. The QR code was invented in the 1990s by the Japanese company Denso Wave. In India, the QR code payment system generally supports three different types of QR code payments namely Bharat QR, UPI QR, and Proprietary QR. On October 22, 2020, the Reserve Bank of India (RBI) prohibited Payment System Operators (PSOs) from launching new proprietary QR codes for payment transactions. Instead, they were directed to adopt at least one interoperable QR code, allowing the same QR code to be used across multiple payment applications. This initiative aims to enhance the digital payments infrastructure in the country.

Bharat QR is an interoperable QR-based payment solution that enables Person-to-Merchant (P2M) digital transactions. Developed by the National Payments Corporation of India (NPCI) in collaboration with Mastercard and Visa, Bharat QR serves as an integrated digital card payment system in India. There is no need to carry cash, and customers do not incur any additional charges when making payments through Bharat QR. You can use any app that supports Bharat QR to pay using a card (via Visa, Mastercard, Amex, or Rupay) or BHIM-UPI.

To use Bharat QR for payments at a store, follow these steps: look for the Bharat QR receipt and QR code at the billing counter, scan the merchant's QR code or enter the Bharat QR merchant ID in your payment app, for online bill payments, find the Bharat QR receipt and QR code on the payment or billing page while making a purchase, either scan the QR code or input the numeric merchant ID. and enter the amount to be paid. Scanning the QR code will automatically display this amount. Bharat QR was developed by the payments industry to help facilitate India's transition to a cashless society.

The functionality of the Bharat QR Code is similar to the transaction process through a POS Terminal. Merchants can enjoy the salient features of Bharat QR such as without paying rental, maintenance, and installation fee. It is also free to install the Bharat QR code function. Helpdesk/email to resolve issues works just like POS. There are not any hidden charges. The transaction proceeds will be credited to the merchant's account on the next business day and MDR is the same as POS.

Nigeria's National QR Code Payment System: Nigeria Quick Response Code (NQR)

This innovation set the stage for several African countries, including Nigeria. In 2020, Ghana became the first African country to launch a universal QR code payment solution, highlighting the significance of QR codes in facilitating digital and cashless payments. This innovation has prompted several payment companies to work for years to promote the adoption of QR codes worldwide, benefiting both merchants and consumers.

In 2007, the Central Bank of Nigeria (CBN) introduced its Payment System Vision 2020, which outlined recommendations to enhance the resilience of payment system infrastructure and workflows, thereby encouraging the use of electronic payment methods. One of the outcomes of this vision was the launch of the Nigeria Quick Response (NQR) Code on March 16, 2021. This QR code-based payment solution, developed by the Nigeria Interbank Settlement System Plc (NIBSS) in collaboration with the CBN, offers a fast, easy, secure, reliable, and contactless method for receiving and making payments for goods and services. The NQR is powered by NIBSS on behalf of Nigeria's Financial Services Industry. A QR code is a type of matrix barcode that encodes information in a square grid format, consisting of black squares on a contrasting background. It can be scanned by an imaging device, processed, and transmitted using appropriate technology.

The Central Bank of Nigeria (CBN) regulated financial services industry released operational guidelines/framework in January 2021 ahead of its March 2021 launch. The Central Bank of Nigeria launched the framework for QR code payments in a circular titled: "Framework for Quick Response (QR) Code Payments in Nigeria," setting out acceptable QR code standards for implementing QR payments in Nigeria; interoperability of QR payments; roles and responsibilities of participants; and risk management principles for QR code payments. The CBN stated that the guidelines were aimed at fulfilling its mandate to ensure the security and stability of the Nigerian financial system, promote the use and adoption of electronic payments, and foster innovation in the payment system. The framework provides regulatory guidance for the operation of the scheme and aims to ensure the proper implementation of QR code standards for secure and efficient payment services in Nigeria.

The NQR payment process is straightforward for both merchants and customers. When a customer is ready to make a payment, the merchant presents the NQR code. The customer then opens their mobile banking app to scan the NQR. After scanning, the customer visually verifies the merchant's details and, if necessary, enters the transaction amount. Once the customer authenticates the transaction, the merchant receives a notification that the payment has been credited. Each NQR code contains unique information related to the transaction and is linked to the customer's banking app, which must be activated on their smartphone. This payment solution is designed to be cost-effective for merchants, charging only 1.4% of the transaction value, capped at ₦2,000, similar to local payments in Nigeria.

To use the NQR payment solution, both merchants and customers need a smartphone with internet connectivity for scanning and payment. For those using feature phones, NQR is also accessible via USSD. Merchants can easily register in three steps: contact the bank to register, generate a unique NQR code, and provide that code to customers for scanning and payment.

The appeal of using NQR primarily lies in the low transaction fees that users incur. Additionally, both merchants and customers benefit from numerous advantages compared to other electronic payment platforms. Some key benefits include no cost to use the platform, instant notifications of transactions, and the elimination of disputes due to immediate reconciliation. This provides timely value for money, allowing business owners to plan efficiently and make informed financial decisions that can lead to business growth.

The main goal of the NQR Solution is to enhance financial inclusion and promote a cashless society. The use of NQR codes is not restricted to urban populations; it also meets the needs of rural residents, as individuals can operate their bank's mobile app or use the USSD option. NQR is supported by all banks, and users can maintain the confidentiality of their account numbers. To make a payment, they simply scan the NQR code, authenticate, and complete the transaction, ensuring that the recipient receives instant funds.

Geographical Distribution of QR Code Payment Research

Figure 2 shows that the majority of research on digital payments was conducted in developing countries, with China being the location of the most research(Liu et al., 2021; Lou et al., 2017; Tu et al., 2022; Zheng & Ma, 2022; Zhong & Moon, 2022). This reflects the rapid adoption of digital payment technology in China, driven by advanced technological infrastructure and government policies that support digital transformation. In addition to China, other developing countries such as Thailand (Ponsree, 2024) Bangladesh (Shah Alam et al., 2024), Indonesia (Muchtar et al., 2024), Vietnam (Le, 2022), and India (Nandru et al., 2024), are also the focus of the research. Meanwhile, research in developed countries such as the United States (Kirby et al., 2015) and Russia (Burtakov et al., 2023) is more limited, suggesting that digital payments may have reached a stable level of adoption in those

countries. The distribution of citations suggests that research in China has a significant influence on the literature, with several studies frequently referenced (Liu et al., 2021; Zheng & Ma, 2022).

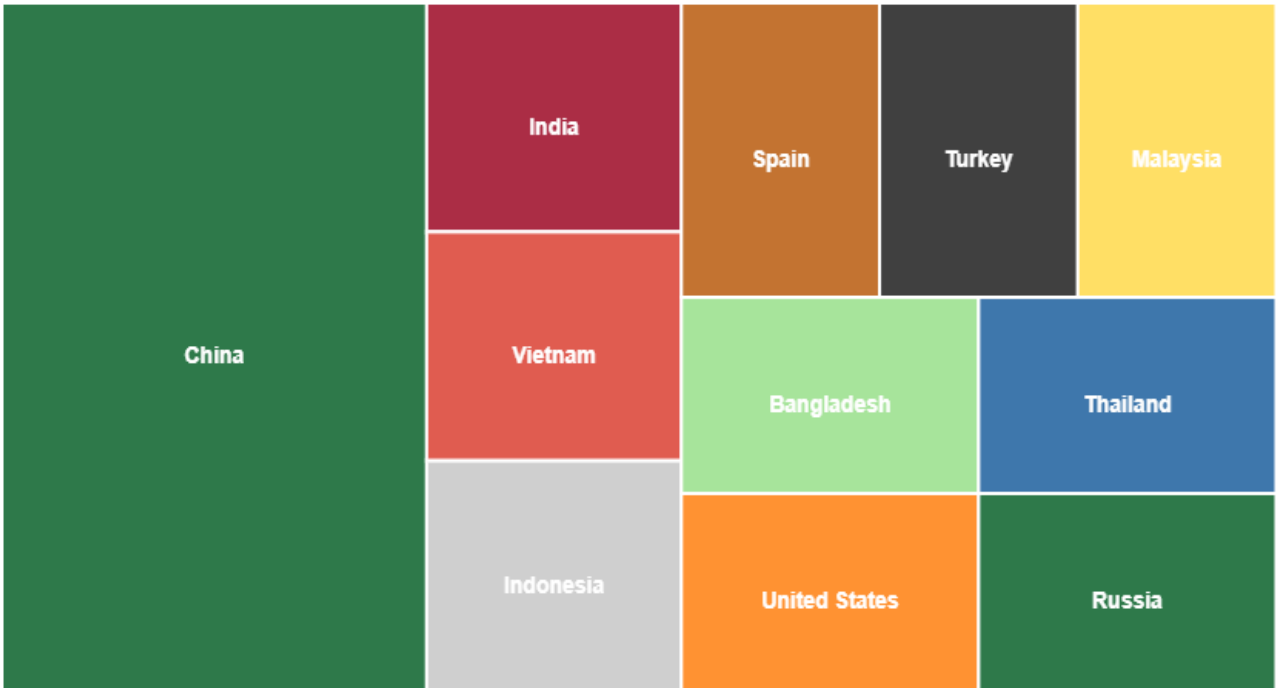

Figure 2. Geographic distribution of studies

Research in other developing countries is also starting to gain attention, especially related to the adoption of QR code payments during the COVID-19 pandemic (Le, 2022; Ponsree, 2024). However, research in developed countries such as the United States and Russia has lower citations, perhaps due to its more specific focus on technical aspects or system implementation (Burtakov et al., 2023; Kirby et al., 2015). Contextual trends show that digital payments, especially QR code payments, are becoming a major focus in developing countries due to their potential to improve financial inclusion and transaction efficiency. The COVID-19 pandemic has also been an important catalyst in driving the adoption of digital payments, as seen in studies in Thailand, Vietnam, and China (Le, 2022; Ponsree, 2024; Tu et al., 2022).

On the other hand, research in developed countries focuses more on the technical and evaluation aspects of the system, showing differences in priorities in the context of technology adoption. The implication of this trend is the importance of further research to understand the factors influencing the adoption of digital payments across a variety of geographic and cultural contexts. In addition, there needs to be a more in-depth exploration of the impact of digital payments on social and economic aspects, such as financial inclusion, consumer satisfaction, and business growth (Muchtar et al., 2024; Shah Alam et al., 2024). Challenges ahead include improving system security, building user trust, and addressing barriers to adoption in rural or underdeveloped areas (Nandru et al., 2024). Future research opportunities include cross-cultural studies, longitudinal analysis, and the integration of new technologies such as Near Field Communication (NFC) in digital payment systems(Lou et al., 2017; Yan et al., 2021). As such, the theme of digital payments remains relevant and offers many opportunities for innovative research that can contribute to the transformation of the global digital economy.

Figure 3 shows that quantitative research design dominates with 13 out of 15 studies using this approach. The most widely used quantitative method is survey, with Structural Equation Modeling (SEM) and Partial Least Squares-Structural Equation Modeling (PLS-SEM) analysis techniques as the

main choices (Ponsree, 2024; Shah Alam et al., 2024; Yan et al., 2021). The use of SEM and PLS-SEM shows a focus on testing causal relationships between variables, especially in the context of the adoption of digital payment technology. Meanwhile, only one study used qualitative design, Kirby et al. (2015), which relied on interviews and document analysis to explore specific contexts in the United States. The citation distribution shows that studies with a quantitative design tend to be more referenced, especially those using SEM and PLS-SEM. For example, research by Liébana-Cabanillas et al. (2015) and Tu et al. (2022) using SEM and PLS-SEM respectively, shows the popularity of this method in analyzing the adoption of digital payment technology. This indicates that a quantitative approach is considered more relevant to measure the factors influencing the adoption and use of digital payment systems.

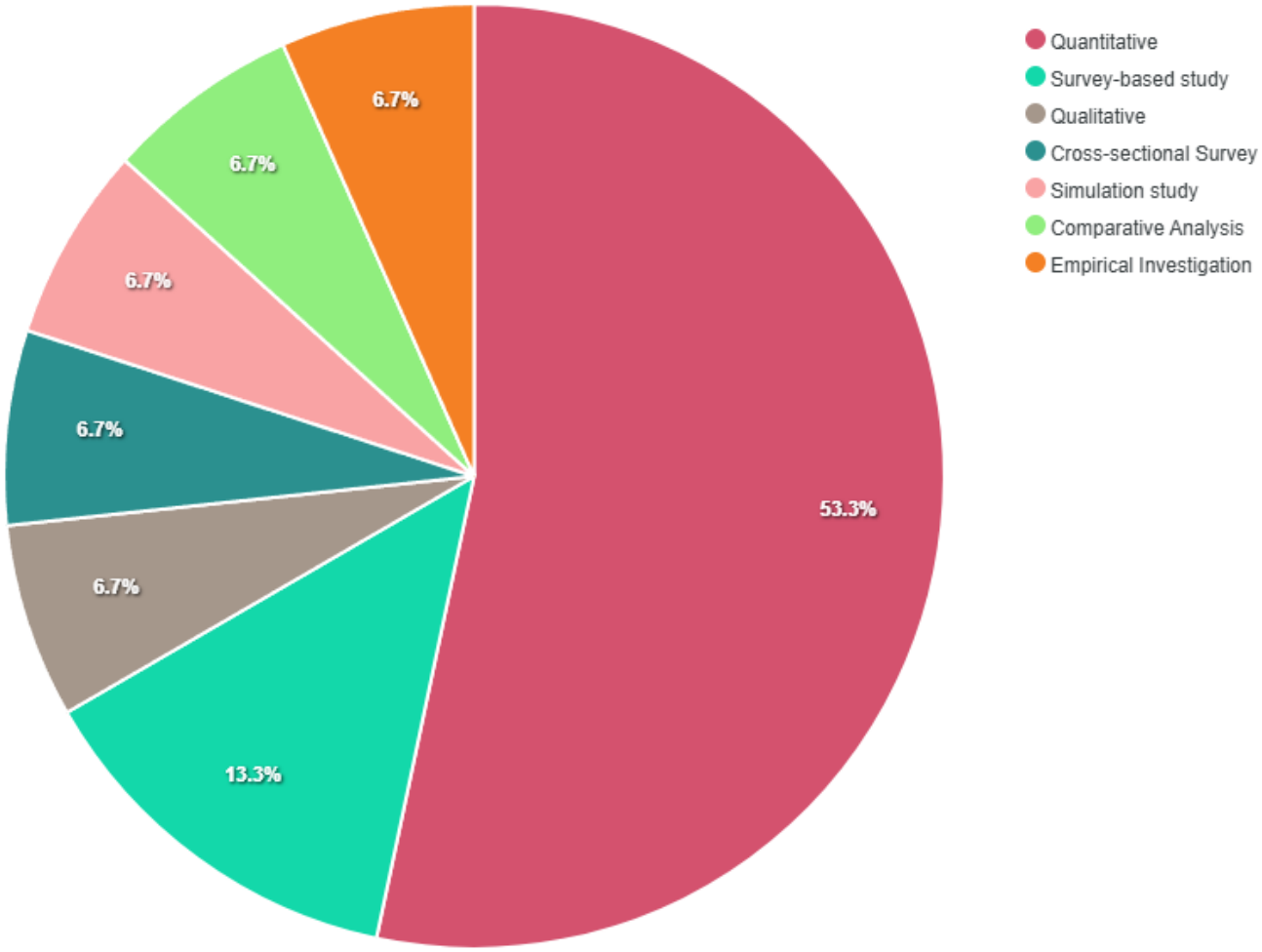

Figure 3. Methods classification

The implication of this trend is that future research will need to broaden the scope of the methodology, including incorporating qualitative approaches to gain a deeper understanding of the social and cultural contexts influencing the adoption of digital payments. In addition, future research can utilize mixed methods to combine the strengths of quantitative and qualitative approaches. The theme of digital payments remains relevant given the global transformation towards a cashless society and challenges such as security, privacy, and financial inclusion (Muchtar et al., 2024; Shah Alam et al., 2024). As such, future research needs to focus on these aspects to support the development of inclusive and sustainable digital payment systems.

Table 3. Journal classification

No.	Writer	Year (Citation)	Title	Journal
1	Yan, L.-Y., Tan, G. W.-H., Loh, X.-M., Hew, J.-J., & Ooi, K.-B.	2021 (179)	QR code and mobile payment: The disruptive forces in retail.	Journal of Retailing and Consumer Services
2	Liébana-Cabanillas, F., Ramos De Luna, I., & Montoro-Ríos, F. J.	2015 (150)	User behaviour in QR mobile payment system: the QR Payment Acceptance Model.	Technology Analysis and Strategic Management
3	Türker, C., Altay, B. C., & Okumuş, A.	2022 (58)	Understanding user acceptance of QR code mobile payment systems in Turkey: An extended TAM.	Technological Forecasting and Social Change
4	Lou, L., Tian, Z., & Koh, J.	2017 (56)	Tourist satisfaction enhancement using mobile QR code payment: An empirical investigation.	Sustainability
5	Zhong, Y., & Moon, H.-C.	2022 (38)	Investigating Customer Behavior of Using Contactless Payment in China: A Comparative Study of Facial Recognition Payment and Mobile QR-Code Payment.	Sustainability
6	Liu, R., Wu, J., & Yu-Buck, G. F.	2021 (33)	The influence of mobile QR code payment on payment pleasure: evidence from China.	International Journal of Bank Marketing
7	Tu, M., Wu, L., Wan, H., Ding, Z., Guo, Z., & Chen, J.	2022 (32)	The Adoption of QR Code Mobile Payment Technology During COVID-19: A Social Learning Perspective.	Frontiers in Psychology
8	Zheng, H., & Ma, W.	2022 (25)	Scan the QR Code of Happiness: Can Mobile Payment Adoption Make People Happier?	Applied Research in Quality of Life
9	Le, X. C.	2022 (19)	The diffusion of mobile QR-code payment: an empirical evaluation for a pandemic.	Asia-Pacific Journal of Business Administration
10	Kirby, G., Caronongan, P., Malone, L. M., & Boller, K.	2015 (14)	What do quality rating levels mean? Examining the implementation of QRIS ratings to inform validation.	Early Childhood Research Quarterly
11	Nandru, P., S.A., S. K., & Chendragiri, M.	2024 (9)	Adoption intention of mobile QR code payment system among marginalized street vendors: an empirical investigation from an emerging economy.	Journal of Science and Technology Policy Management
12	Burtakov, I., Kureev, A., Tyarin, A., & Khorov, E.	2023 (9)	QRIS: A QuaDRiGa-Based Simulation Platform for Reconfigurable Intelligent Surfaces.	IEEE Access
13	Muchtar, E. H., Trianto, B., Maulana, I., Alim, M. N., Marasabessy, R. H., Hidayat, W., Junaedi, E., & Masrizal.	2024 (8)	Quick response code Indonesia standard (QRIS) E-payment adoption: customers perspective.	Cogent Business and Management
14	Shah Alam, S., Ahmed, S., Kokash, H. A., Mahmud, M. S., & Sharnali, S. Z.	2024 (6)	Utility and hedonic perception- Customers' intention towards using of QR codes in mobile payment of Generation Y and Generation Z.	Electronic Commerce Research and Applications
15	Ponsree, K.	2024 (3)	QR code payment in Thailand 4.0 era: expand the understanding of perceived susceptibility to COVID-19 in the TAM theory.	Current Psychology

Distribution of Journals that Publish Research on QR Code Payment

Table 3 shows that the majority of studies used quantitative methods with a survey approach as the main data collection technique. The dominant analytical methods are Structural Equation Modeling (SEM) and Partial Least Squares-Structural Equation Modeling (PLS-SEM), which are used to test the relationships between variables in the context of digital payment technology adoption, particularly QR codes (Ponsree, 2024; Shah Alam et al., 2024; Yan et al., 2021). The journals used are categorized in Q1 and Q2 tiers, focusing on the fields of technology, psychology, and management, such as Technological Forecasting and Social Change, Sustainability, and Journal of Retailing and Consumer Services. The citation distribution shows that these studies frequently refer to theoretical models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), which are expanded with contextual variables such as perceptions of COVID-19 risk (Le, 2022; Tu et al., 2022).

The implications of this trend are that the adoption of digital payments, particularly QR codes, is influenced by factors such as trust, ease of use, and social norms, with the COVID-19 pandemic context serving as a significant trigger (Liu et al., 2021; Zhong & Moon, 2022). However, there are still research gaps, such as a lack of qualitative studies and cross-context exploration (Muchtar et al., 2024; Nandru et al., 2024). The relevance of this theme to future research challenges and opportunities lies in the need to explore new payment technologies such as Near Field Communication (NFC) and integration with inclusive financial systems, particularly in developing countries (Burtakov et al., 2023; Yan et al., 2021). Additionally, future research should consider more diverse demographic factors and the long-term impact of digital payment adoption on societal well-being (Zheng & Ma, 2022).

Theories That Have Been Used in QR Code Payment Research

The analysis of table 4 on digital payments shows that the Technology Acceptance Model (TAM) is the most dominant theory used in related studies. TAM was used in the study by Liébana-Cabanillas et al. (2015), Türker et al. (2022), and Zhong & Moon (2022). This theory focuses on users' perceptions of the ease of use and benefits of technology, which is relevant in the context of the adoption of QR code-based payment systems.

In addition to TAM, the Unified Theory of Acceptance and Use of Technology (UTAUT) is also widely applied, as in the research of Muchtar et al. (2024), Nandru et al. (2024), and Shah Alam et al. (2024). UTAUT emphasizes factors such as performance expectations, effort, and social influence, which are key in understanding the adoption of digital payment technology, especially in developing countries such as Indonesia and India. The distribution of citations from these theories suggests that TAM and UTAUT are often used in the context of countries with developing technology adoption rates, such as China, India, and Indonesia. This indicates that these two theories are considered relevant to explain the phenomenon of digital payment technology adoption in these regions.

In addition, the use of Structural Equation Modeling (SEM) as the dominant analysis method (Ponsree, 2024; Shah Alam et al., 2024; Türker et al., 2022) reinforce the validity of findings based on such theories. The implication of this trend is that TAM and UTAUT provide a strong theoretical framework for understanding the factors influencing the adoption of digital payments, especially in the context of the COVID-19 pandemic accelerating digital transformation (Tu et al., 2022; Zhong & Moon, 2022). However, it should be noted that these theories may need to be modified or expanded to accommodate local contexts and rapid technological change. Future research challenges include exploring new theories or integrating more comprehensive theories to understand the dynamics of digital payment adoption, especially in the face of security, privacy, and financial inclusion challenges.

Table 4. Theory classification

No	Theory	Variable	Researcher
1	Diffusion of Innovation Theory; Theory of Reasoned Action (TRA)	Attitude Toward Usage Compatibility Complexity Current Usage Image Observability Relative Advantage Transaction Satisfaction Travel Satisfaction Trialability	Lou et al. (2017)
2	Mobile Technology Acceptance Model (MTAM)	Behavioral Intention Mobile Ease of Use Mobile Usefulness Optimism Perceived Transaction Convenience Perceived Transaction Speed Personal Innovativeness	Yan et al. (2021)
3	Social Learning Theory	Behavioral Intention Health Benefit Perceived Severity Social Influence Utilitarian Benefit	Tu et al. (2022)
4	Technology Acceptance Model	Continuous Usage Habit Perceived Ease of Use Perceived Usefulness Perceived Value Service Security User Satisfaction Word-Of-Mouth	Zhong & Moon (2022)
5	Technology Acceptance Model (TAM)	Attitude Intention to Use Perceived Compatibility Perceived Ease of Use Perceived Usefulness Personal Innovativeness Subjective Norms	Liébana-Cabanillas et al. (2015)
6	UTAUT2 Theory	Behavioral Intention Effort Expectancy Facilitating Conditions Performance Expectancy Social Influence	Muchtar et al. (2024)

CONCLUSION

The context of this research is the implementation of QR codes in developed countries to determine which implementations are already in use. The methodology of this research expands on qualitative research methods, case studies, and mixed methods to more comprehensively explore the dynamics of QR code payment adoption.

Based on the literature review of this research, the researchers draw several conclusions. First, the practice of the National QR Code Payment System in three countries shows a diverse approach but has a similar goal of encouraging financial inclusion and payment efficiency. Second, the geographical distribution of research is concentrated in the Asian region, especially in China. Third, regarding the classification of research methods, most QR code payment research uses a quantitative approach based on surveys and statistical analysis. This is because the researchers want to see the implementation in general. Fourth, the distribution of journals QR code payment research publications are widely published in journals in the fields of information technology, information systems, and digital business. Fifth, commonly used theories include the Technology Acceptance Model (TAM). Sixth, the contribution of research models focuses on the factor of technology acceptance by consumers. While aspects such as transaction security, data protection, and the macroeconomic impact of QR code payments are still rarely the main focus. Seventh, the knowledge gap is based on the TCM Framework Theory, which is the use of the Extended Technology Acceptance Model (ETAM) or Innovation Diffusion Theory (IDT).

Future research should focus on conducting empirical studies to assess the direct impact of QR code payment usage on business performance and transaction usage, as well as the impact of financial literacy on payment usage. In addition, because the implementation of QR payment varies in each country, it is also necessary to discuss the study of national regulations and the role of government in standardization, supervision, and incentives (e.g., MDR subsidies or taxes).

This research provides a theoretical contribution by mapping previous research on cashless payments, especially QR codes, in Indonesia, India, and Nigeria. In addition, it also provides literature development on the development of technology validation funds, especially the use of QR. Therefore, further research can use the results of this study in selecting the theory used in relevant research, independent variables, and dependent variables.

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