Adoption of QRIS digital payment in Indonesia and Malaysia: A technology acceptance and knowledge perspective

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Abstract

This study explores the adoption of QR-based digital payment systems, focusing on the Quick Response Code Indonesian Standard (QRIS), through the integration of the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), with Cultural Intelligence (CI) as a mediating construct. Based on survey data from 400 users in Indonesia and Malaysia, analyzed using Structural Equation Modeling with Partial Least Squares (SEM-PLS), the findings show that Perceived Ease of Use and Perceived Usefulness significantly influence both CI and the intention to use QRIS. In contrast, Trust plays a comparatively weaker role. Framed within the Mode 2 Knowledge Production paradigm, QRIS is conceptualized as a dynamic socio-technical infrastructure shaped by user experience, social learning, and cultural adaptation. This study contributes to innovation adoption theory and offers practical guidance for advancing digital financial inclusion in multicultural Southeast Asian contexts.

1. Introduction

The transformation of digital payment systems in Southeast Asia has accelerated markedly, driven by rapid advancements in financial technology (FinTech) and increasing demand for efficient cross-border transactions. Mobile banking has emerged as a central pillar of financial service delivery [1]. However, disparities in national regulatory frameworks remain a key barrier to interoperability and seamless regional collaboration [2]. FinTech not only improves economic efficiency but also serves as a catalyst for sustainable development and the green economy. Among the notable

innovations are QR-based payment systems, implemented through various strategies in Malaysia and Indonesia [3]. Yet, regulatory fragmentation contributes to inefficiencies, delays in cross-border integration, and constrains the global competitiveness of FinTech ecosystems. While countries such as India and Indonesia are advancing comprehensive digital transformation policies, the European Union continues to face innovation barriers due to heterogeneous national implementation [4, 5].

Regulatory sandboxes have been introduced as practical tools to strike a balance between innovation and consumer protection [6]. Nonetheless, overly rigid regulations can hinder startup growth, especially in emerging markets, and open the door to regulatory arbitrage [7, 8]. In this context, Indonesia's Quick Response Code Indonesian Standard (QRIS), developed by Bank Indonesia, unifies digital payments under a single code to improve user accessibility. Its adoption has expanded rapidly across Asia, including Malaysia, Singapore, Thailand, South Korea, India, the UAE, and Japan [9]. Understanding the broader adoption of QR-based payments requires attention to user-centered constructs such as Perceived Ease of Use, Perceived Benefits, Trust, and Cultural Intelligence (CI), all of which influence user intention [10-13]. Cultural acceptance, in particular, plays a pivotal role in building trust toward FinTech services, as cross-cultural interactions enhance knowledge exchange, social networks, and perceived utility [14, 15]. Despite the high technological openness among youth in Indonesia and Malaysia, variations in cultural norms and financial literacy result in differentiated adoption patterns [16]. Therefore, understanding how user experience, service diversity, and cultural alignment affect FinTech adoption is essential.

This study employs an integrated theoretical framework that combines the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) [17]. While TAM emphasizes Perceived Ease of Use and Perceived Usefulness, UTAUT expands this perspective by incorporating Trust, social influences, and facilitating conditions. This research specifically examines how Perceived Ease of Use, Perceived Benefits, and Trust influence users' intention to use QRIS. Cultural Intelligence (CI) is introduced as a mediating variable, reflecting the critical role of cultural adaptability in cross-border FinTech adoption, particularly between culturally proximate yet distinct countries such as Indonesia and Malaysia. Moreover, this study is grounded in the Mode 2 Knowledge Production paradigm, which emphasizes contextual, user-driven knowledge generated through social learning and lived experience, highlighting how technological design and cultural adaptation jointly shape FinTech adoption.

Although extensive literature has addressed the technical and regulatory aspects of QR payment systems, few studies have examined user behavior across varied national and cultural contexts. This gap is especially pronounced among micro, small, and medium-sized enterprises (MSMEs), which constitute the economic backbone of both Indonesia and Malaysia and are directly impacted by the adoption of QR-based payments. Beyond their transactional function, QR systems act as instruments of social learning and behavioral transformation within local economies [18]. However, empirical research on CI, social learning, and knowledge exchange remains limited. Accordingly, this study investigates the adoption of QRIS in Indonesia and Malaysia by assessing the roles of ease of use, perceived benefits, trust, and CI in shaping user intention.

This research adopts the Mode 2 Knowledge paradigm by positioning QR-based payment systems as dynamic, user-centered knowledge infrastructures rooted in everyday practices. Unlike traditional top-down diffusion models, this approach emphasizes context-sensitive knowledge production, wherein FinTech adoption is shaped by users' lived experiences and adaptive capabilities. QRIS and similar systems are thus viewed not merely as technological tools but as socio-technical constructs co-produced through regulatory, cultural, and behavioral interactions. Integrating Cultural Intelligence into the innovation adoption framework deepens our understanding of how users interpret, evaluate, and adopt technologies in multicultural and cross-institutional settings, particularly in the Indonesian–Malaysian context. Through this lens, the study contributes to the literature on international innovation diffusion by showing how cultural norms, institutional readiness, and policy frameworks collectively shape user engagement and FinTech behaviors across national borders.

The Southeast Asian digital payment landscape represents a vibrant yet fragmented ecosystem shaped by the intersection of technological acceleration and regulatory diversity. The rapid increase in mobile penetration and broadband access has propelled mobile-based financial services into everyday life [19, 20]. As of 2022, Southeast Asia had over 326 million active smartphone users, accounting for more than 88% of internet users. These figures strongly correlate with the growth of digital wallets and QR payment adoption [21]. Nevertheless, significant disparities in infrastructure persist, especially between urban and rural areas. These gaps, driven by unequal internet access, varying digital literacy levels, and income inequality, continue to impede financial inclusion and limit the scalability of digital payment solutions [22, 23].

Moreover, MSMEs, the economic foundation of both Indonesia and Malaysia, frequently face resource constraints and capability limitations in adopting digital tools. While government initiatives increasingly support digital transformation and cashless transactions, the readiness and absorptive capacity of MSMEs vary significantly [24]. In addition to technological and organizational barriers, regulatory fragmentation presents further challenges to the standardization of digital payments. Inconsistencies in e-government strategies, differing supervisory structures, and the absence of harmonized data governance frameworks have created a patchwork regulatory environment that can undermine user trust [25].

Concerns about cybersecurity and data privacy further heighten user hesitation. In response, national standardization programs such as Indonesia's QRIS aim to unify fragmented ecosystems and build trust through secure, interoperable platforms. However, their long-term success hinges on the alignment of secure technical infrastructure, transparent policy implementation, and sustained user confidence [18]. Against this backdrop, this study provides both theoretical and practical insights by offering a culturally grounded, cross-national analysis of QR payment adoption, with a particular focus on inclusive innovation and the empowerment of MSMEs through digital financial inclusion.

2. Theoretical Background and Hypotheses

2.1. Digital Payment Innovation and Regulatory Challenges in Southeast Asia

Innovation in digital payment systems across Southeast Asia exemplifies the rapid financial transformation propelled by fintech penetration. This evolution occurs alongside governmental efforts to modernize financial infrastructures; however, regulatory fragmentation remains a key constraint on interoperability and cross-border coordination [2, 4]. In contrast, the European Union has implemented a unified regulatory approach, but challenges in national-level implementation continue to hinder the diffusion of innovation [5]. As a responsive mechanism, regulatory sandboxes have emerged to balance consumer protection with supporting innovation [6], though overly rigid frameworks risk stifling startup development, especially in emerging economies [7].

2.2. QR Payment Systems as Knowledge Infrastructure: The Case of QRIS

Indonesia's QRIS (Quick Response Code Indonesian Standard), launched by Bank Indonesia, illustrates how payment systems evolve into knowledge infrastructures, fostering not only digital financial inclusion but also enabling regional socio-technical learning. With QRIS now interoperable with payment networks in Malaysia, Singapore, Thailand, India, and several Gulf states [9], its diffusion highlights regulatory learning and behavioral adoption across jurisdictions. Compared with Malaysia's DuitNow, QRIS demonstrates context-specific strategies shaped by local adoption patterns [3]. Recent scholarship confirms the potential of mobile payment infrastructures to contribute to environmental sustainability. Studies show that QR code-based fintech optimizes resource allocation and energy efficiency, supporting low-emission economic sectors [26-28]. Such systems thus function as knowledge platforms capable of transmitting signals for green economic behavior. In underbanked regions, QR-based tools increase access to credit and digital financial services, especially for marginalized communities and agricultural sectors [29, 30]. However, inclusive policy interventions remain critical to ensure accessibility for populations with low digital literacy [31, 32].

2.3. Perceived Ease of Use and Perceived Benefits to Intention to Use.

Under the Technology Acceptance Model (TAM), Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) are fundamental in predicting user behavioral intention. These constructs influence technology acceptance across platforms, including during the pandemic, where risk-averse consumers opted for technologies offering practical utility [10, 11, 33]. The digital banking sector has similarly confirmed the role of these perceptions in shaping user engagement [34]. In the QRIS context, ease of use lowers entry barriers, while perceived usefulness enhances utility value, particularly for micro-entrepreneurs seeking efficiency and market access [11]. Trust emerges as a necessary third variable, extending TAM's explanatory power, especially in mobile finance environments across Turkey and Brazil [35]. In Muslim societies, trust and religiosity co-produce digital adoption, particularly for philanthropic transactions like *sadaqah* [36]. Thus, user perception constructs are shaped both by technological affordances and by social variables such as religiosity and moral economy [37].

2.4. Trust and Intention to Use

Trust acts as a moderating force against perceived risk in digital environments. It not only influences the intention to use but also mediates the relationship between risk perception and adoption. In fragile environments, such as informal mobile money networks, trust in intermediaries is often more consequential than trust in central systems [38]. Even in mature financial systems, trust influences engagement, albeit to a lesser degree [39]. Global studies highlight trust and security as persistent challenges in fintech adoption [40]. Recommendations for enhancing trust include greater system transparency and risk management protocols [41, 42]. With blockchain applications, trust hinges on user confidence in technical integrity [43]. Perceived risk diminishes adoption intent, unless offset by proven reliability [44]. Importantly, cross-border payment trust is shaped by prior experiences, peer influence, and platform reputation, underscoring its socio-cognitive dimension [12, 16].

2.5. Cultural Intelligence (CI) and Intention to Use

Cultural Intelligence (CI) refers to individuals' ability to adapt and act effectively across cultures. In fintech contexts, CI enables users to interpret and navigate culturally embedded digital interfaces, enhancing social learning and behavioral readiness [13]. Conceptualized CI as a multidimensional construct encompassing metacognitive, cognitive, motivational, and behavioral competencies [45]. In digital transformation settings, CI promotes intercultural alignment, strengthens cross-cultural teamwork, and fosters technological adaptability [2, 46]. Design strategies that embed local narratives can enhance UX and adoption rates [47]. For organizations, CI is pivotal in operationalizing inclusive strategies across borders [48].

2.6. Perceived Benefits and Continued Usage

Perceived benefits (PB) are consistently among the top drivers of adoption intent, particularly for m-payments and QR systems. Users value transactional convenience, speed, and cost-efficiency [49, 50]. Among Gen Z, adoption accelerates when technology aligns with daily habits [46]. In Malaysia's retail sector, perceived benefits intersect with variables like product ethics and user experience [1]. However, not all technologies rely on PB to drive uptake. In biometric payments, PB alone does not significantly predict adoption, highlighting the nuanced role of context [51]. In contrast, m-health tools show strong correlations between PB and sustained engagement, particularly among youth [52]. Continued usage is often determined by a post-adoption reassessment of benefit-risk ratios [53].

2.7. Digital Payment Innovations and Behavioral Change

The global shift toward contactless payments, intensified by smartphone ubiquity, has led to new consumer behaviors favoring convenience [35]. Yet infrastructure inequalities persist, especially in low-income regions, necessitating inclusive policy frameworks to address demographic gaps [54]. The emergence of sovereign digital currencies, such as China's RMB, marks a paradigmatic shift in transactional and geopolitical structures [55]. In Southeast Asia, QR-based payment systems have catalyzed MSME growth by lowering entry barriers and supporting digital transformation [18]. However, the trust-security nexus remains critical due to persistent fraud risks [28]. Regulatory consistency varies across countries; Malaysia exhibits smoother system integration, while Indonesia faces fragmented oversight [24].

2.8. Mode 2 Knowledge Perspective on QR-Based Payments

Mode 2 knowledge production shifts attention from lab-based research to practice-based learning, especially in inclusive fintech development. QR payments illustrate this shift where adoption emerges from bottom-up knowledge flows shaped by user feedback, cultural norms, and collaborative design [56]. User diversity drives customization: tech-savvy youth adopt quickly, while older or less digitally literate users require culturally attuned interfaces and capacity-building [11, 53]. Community engagement, digital literacy, and co-design initiatives are key enablers [57]. QRIS adoption exemplifies socially embedded fintech shaped through iterative learning and multi-actor participation.

2.9. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) explains digital technology adoption through Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) [17]. Applications range from e-appointments to telemedicine and wearable tech [19]. In digital finance, TAM remains robust but must integrate contextual variables such as trust, security, and cultural fit [43, 58]. TAM adaptation is essential across culturally diverse markets; for instance, in Pakistan and Indonesia, where religious and communal values shape perception [20]. In this study, PEOU, Perceived Benefits, and Trust are examined, with Cultural Intelligence introduced as a mediating variable, reflecting a novel extension of TAM within cross-cultural fintech adoption. This study adopts a multidimensional theoretical approach by integrating classical technology adoption models with contemporary concepts of knowledge production and use. The framework combines three major theoretical strands: the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and Mode 2 Knowledge Production, with Cultural Intelligence (CI) serving as a mediating variable that bridges user technology perceptions with cultural context. The Technology Acceptance Model (TAM), introduced by Davis [59], provides the primary lens to explore the determinants of users' behavioral intention to adopt QR-based digital payment systems such as QRIS. Its core constructs, Perceived Ease of Use (PEOU) and Perceived Usefulness (PU), are key in shaping user attitudes and intentions toward new technologies. In a cross-country setting, TAM helps explain how perceptions of ease and benefit influence QRIS adoption in two distinct cultural environments, Indonesia and Malaysia.

To enrich this framework, the study integrates the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. [17], particularly focusing on the construct of trust, which reflects the importance of user confidence in system security and privacy as a prerequisite for adoption. The combination of TAM and UTAUT allows for a more comprehensive understanding of both rational and affective drivers behind technology adoption decisions. Cultural Intelligence (CI), as defined by Ang et al. [45], refers to an individual's ability to function and adapt effectively in culturally diverse settings. CI is introduced as a mediating variable to capture how technology perceptions and trust are filtered through users' sensitivity and adaptability to different cultural norms. In a cross-national context, CI plays a pivotal role in bridging cultural differences and explaining how innovation is received across social environments. The study draws on the Mode 2 Knowledge Production paradigm [60], which emphasizes knowledge generated not solely through academic channels but also through its real-world application. Under this lens, QRIS is conceptualized as a living knowledge infrastructure, shaped by user experience, social learning, and cultural adaptation. Hence, QRIS is not merely a technological tool but a dynamic socio-technical artifact that evolves through user interaction, cultural norms, and the digital ecosystem. The following hypotheses are proposed:

- H1: Perceived Ease of Use positively influences Cultural Intelligence
- H2: Perceived Benefits positively influence Cultural Intelligence
- H3: Trust positively influences Cultural Intelligence
- H4: Cultural Intelligence positively influences Intention to Use
- H5: Perceived Benefits positively influence Intention to Use
- H6: Cultural Intelligence positively influences Intention to Use
- H7: Cultural Intelligence mediates the effects of Perceived Ease of Use, Perceived Benefits, and Trust on Intention to Use.

3. Data and Methodology

This study adopts a quantitative, cross-sectional research design to investigate the factors influencing the adoption of QR-based digital payment systems, with a specific focus on the Quick Response Code Indonesian Standard (QRIS). The research integrates constructs from the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and Cultural Intelligence (CI), all within the theoretical framework of Mode 2 Knowledge Production. Primary data were obtained through an online structured questionnaire distributed to individual users of QRIS

in Indonesia and Malaysia. A total of 400 valid responses were collected from Indonesian and Malaysian citizens who had prior experience using QR-based payment systems in their respective countries.

Stratified sampling was employed to ensure representation across varied demographic and socioeconomic backgrounds. Each construct was measured using multi-item scales adapted from validated prior studies, with minor contextual adjustments for the QRIS setting. Respondents rated each item on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The latent variables measured include Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Trust, Cultural Intelligence (CI), and Intention to Use (ITU). Data were analyzed using Structural Equation Modeling with Partial Least Squares (SEM-PLS), utilizing SmartPLS 4.0. This method was selected for its suitability in handling complex models involving latent variables. The measurement model was assessed for internal consistency, convergent validity, and discriminant validity, while the structural model was evaluated for path coefficients, R^2 values, and mediation effects through bootstrapping. This methodological approach offers a robust analysis of the causal pathways underlying QRIS adoption, while providing empirical evidence on the mediating role of cultural intelligence in a cross-national digital payment context.
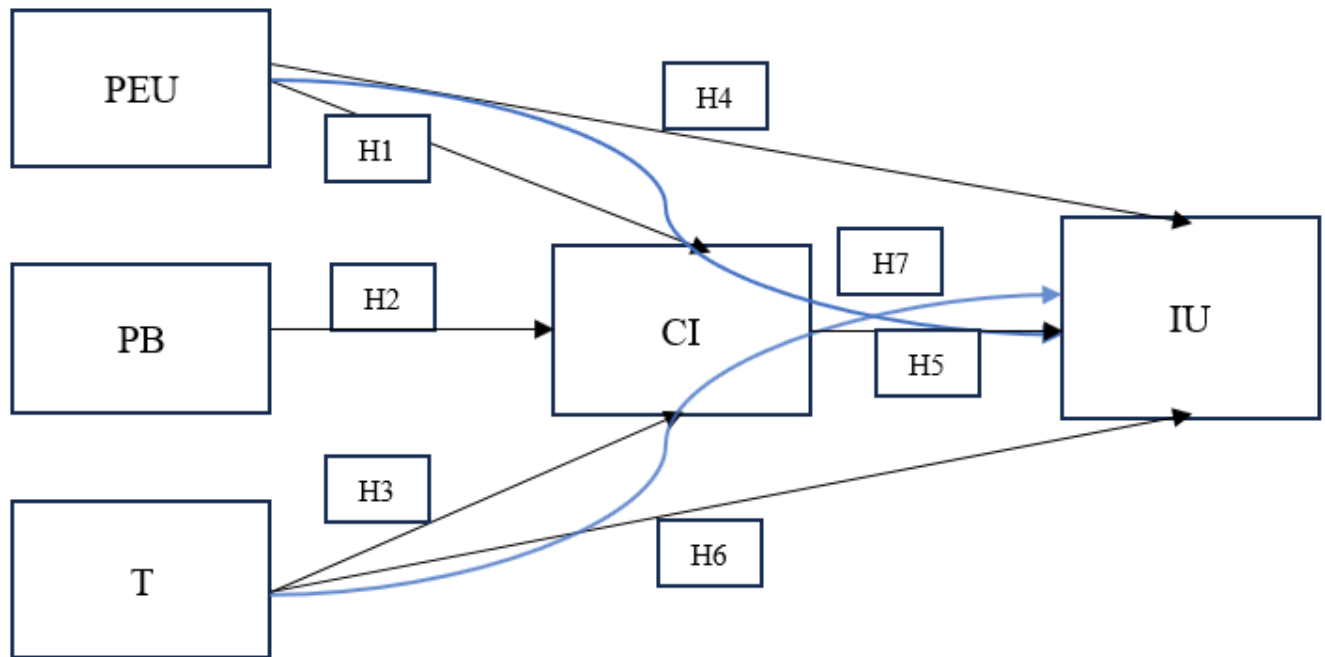

Figure 1.
Research Conceptual Framework.
Note:
Structural Path
Partial Moderation

4. Results and Discussion
4.1. Descriptive Analysis
4.1.1. Respondent Description

There were 400 respondents, with 200 each from Indonesia and Malaysia. The QRIS users in these two countries were, therefore, well represented. Of the total, 56.25% were women, while 43.75% were men, showing a slight dominance in female participation in using QRIS. The age groups were fairly divided into four categories: 18-24 years old (40%), 25-34 years (30%), 35-44 years (20%), and 45-54 years (10%). Most QRIS users are in the young-to-middle age group; there is a decrease in the number of respondents as age increases. This indicates that younger users are more likely to adopt digital payment technology, although there is still participation from older age groups, though in smaller proportions. The information of the respondents can be viewed in Table 1.

Table 1.
Demographic profile of QRIS users.

	QRIS users (n=400)	
	Sub-total	**% to n**
Nationality		
Indonesia	200	50
Malaysia	200	50
Gender		
Male	175	43.75
Female	225	56.25
Age		
18-24 years	160	40
25-34 years	120	30
35-44 years	80	20
45-54 years	40	10

Note: ***Statistical significance at 0.05
Source: Authors' calculations based on the survey questionnaire.

4.1.2. Testing Hypotheses

Table 2.
Path Coefficient SmartPLS Bootstrapping Output.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (Stdev)	T Statistics (|O/Stdev|)	P Values	Result
PEU -> CI	0.570	0.573	0.044	12.429	0.000	Supported
PEU -> IU	0.48	0.552	0.048	11.790	0.000	Supported
CI → IU	0.350	0.352	0.054	6.386	0.000	Supported
PB ->CI	0.342	0.337	0.056	6.258	0.000	Supported
T -> IU	0.185	0.180	0.024	5.024	0.000	Supported
PB ->IU	0.120	0.118	0.053	3.461	0.001	
T -> CI	0.081	0.084	0.041	2.002	0.046	Supported

The results of the structural model estimation in Table 2 indicate that all hypothesized paths are statistically significant, as the *p*-values for each relationship are below the 0.05 threshold. Furthermore, the *t*-statistics exceed the minimum critical value of 1.96 for a 95% confidence level, indicating robust support for the proposed hypotheses. First, Perceived Ease of Use (PEU) has a strong and positive effect on Cultural Intelligence (CI) ($\beta = 0.570$, $t = 12.429$, $p < 0.001$), supporting the argument that ease of use directly enhances individuals' cultural adaptability. PEU also exerts a significant direct influence on Intention to Use (IU) ($\beta = 0.480$, $t = 11.790$, $p < 0.001$), suggesting that higher perceived ease of use can directly drive user intention, independent of cultural intelligence. Similarly, Cultural Intelligence (CI) positively impacts IU ($\beta = 0.350$, $t = 6.386$, $p < 0.001$), confirming its mediating role in translating other antecedents into behavioral intentions. Perceived Benefits (PB) significantly influence CI ($\beta = 0.342$, $t = 6.258$, $p < 0.001$) and exert a smaller but significant direct effect on IU ($\beta = 0.120$, $t = 3.461$, $p = 0.001$). This suggests that while PB primarily drives intentions through enhancing CI, a direct influence on intention also exists. In addition, Trust (T) has a positive effect on IU ($\beta = 0.185$, $t = 5.024$, $p < 0.001$) and a smaller but statistically significant effect on CI ($\beta = 0.081$, $t = 2.002$, $p = 0.046$). These findings indicate that trust can both enhance cultural intelligence and directly stimulate intention to use. Overall, the structural model demonstrates that PEU is the strongest predictor of CI, while both PEU and CI emerge as key determinants of IU. The statistical evidence confirms the theoretical proposition that CI partially mediates the effects of PEU, PB, and T on IU, aligning with prior literature in digital adoption and cross-cultural behavioral studies.

4.2. Robustness Analysis

Multicollinearity diagnostics were conducted for both the structural and measurement models using Inner and Outer Variance Inflation Factor (VIF) values. For the structural model, inner VIF values ranged from 2.376 to 4.623, all below the 5.0 threshold [61] and within the conservative limit of 3.3 [62]. The highest values were 4.623 for Cultural Intelligence (CI) and 4.516 for Perceived Ease of Use (PEU) when predicting Intention to Use (IU), indicating moderate but acceptable correlations. Other predictors, such as PB (2.376) and T (2.474–2.668), also showed low collinearity. For the measurement model, outer VIF values ranged from 1.286 to 2.106, well below critical thresholds. The highest value was 2.106 (PEU5), while IU1 and IU2 had the lowest (1.286), reflecting minimal shared variance among indicators.

Overall, the results confirm that multicollinearity is not a concern in either model. Path coefficient estimates and construct reliability measures are stable, supporting the robustness of the findings. Specifically, the highest VIF value observed was 2.106 (PEU5), followed by PB4 (2.065) and PB1 (2.064). These values suggest only low to moderate collinearity, indicating that no single indicator is excessively correlated with other predictors in the model. The lowest VIF values were recorded for IU1 and IU2 (both 1.286), indicating minimal shared variance. These findings confirm that multicollinearity is not a concern in this study, and the path coefficient estimates can be considered statistically reliable.

Therefore, the model demonstrates robustness against potential collinearity-related bias, ensuring the stability of the structural relationships identified in the analysis.

5. Discussion

5.1. Theoretical Contributions

This study contributes to the literature on technology adoption and cultural intelligence by integrating the Technology Acceptance Model (TAM) with Cultural Intelligence Theory in the context of digital payment adoption. The results confirm that *Perceived Ease of Use* (PEU), *Perceived Benefits* (PB), and *Trust* (T) significantly influence *Cultural Intelligence* (CI), which in turn affects *Intention to Use* (IU). The identification of CI as a partial mediator between PEU, PB, T, and IU extends existing TAM frameworks by demonstrating the importance of cross-cultural adaptability in explaining behavioral intentions. This strengthens empirical evidence that cultural adaptation is both a contextual factor and a mediating mechanism that amplifies the effects of usability, perceived value, and trust in technology acceptance.

5.2. Practical Contributions

From a practical standpoint, these findings provide actionable insights for digital payment providers and policymakers:
1. Enhancing Usability: Simplifying interface design and reducing operational complexity can foster both ease of use and cultural adaptability among users.
2. Communicating tangible benefits: A Clear demonstration of financial, convenience, and security benefits can encourage users to embrace and adapt to the system more readily.
3. Building Trust: Implementing robust security measures, transparent policies, and reliable customer support can strengthen users' trust, which positively impacts both cultural intelligence and adoption intention.
4. Cultural Sensitivity in Design – Incorporating localized features, language support, and culturally relevant promotional strategies can enhance user engagement in diverse cultural environments.

5.3. Limitations and Future Research

Despite its contributions, this study has limitations. First, the cross-sectional design restricts causal inference; future research could employ longitudinal approaches to examine changes in cultural intelligence and adoption behavior over time. Second, the sample is limited to specific regional contexts, which may affect generalizability; comparative studies across multiple countries and cultures are recommended. Third, while the model integrates PEU, PB, and T as antecedents, other factors such as perceived risk, social influence, and technological self-efficacy could be incorporated for a more comprehensive framework. Finally, future studies could employ mixed-method approaches to capture deeper qualitative insights into how cultural intelligence shapes digital payment adoption decisions.

5.4. Analysis Using the Mode 2 Knowledge Production Framework

This study's findings can be interpreted through the lens of the Mode 2 Knowledge Production Framework proposed by Gibbons [60], which emphasizes knowledge creation as context-driven, problem-focused, and transdisciplinary. In contrast to the traditional Mode 1, which is disciplinary and largely confined to academic contexts, Mode 2 reflects a more dynamic, application-oriented process where knowledge is co-produced by various stakeholders. In this research, the integration of Perceived Ease of Use, Perceived Benefits, Trust, Cultural Intelligence, and Intention to Use reflects a Mode 2 approach in several ways.
1. Context of Application: The research addresses a real-world challenge: promoting the adoption of digital payment systems in culturally diverse user groups. Knowledge is produced in direct response to the practical needs of technology providers, regulators, and end-users, rather than purely for theoretical advancement.
2. Transdisciplinarity: The model combines constructs from technology acceptance theory, cross-cultural psychology, and trust-building literature, thereby moving beyond single-discipline boundaries. The interplay between usability, value perception, trust, and cultural adaptability illustrates how multidisciplinary insights are synthesized to explain behavioral intention.
3. Heterogeneous Collaboration: The study framework inherently engages multiple actors, including technology developers, policymakers, and users, whose diverse experiences and perspectives contribute to shaping culturally adaptive digital solutions.
4. Reflexivity and Social Accountability: Findings underscore the importance of designing culturally sensitive and user-centered systems, aligning technological development with societal values, norms, and cultural diversity. This reflects Mode 2's emphasis on producing knowledge that is socially robust and responsive to end-user needs.

By situating the results within the Mode 2 framework, this research contributes not only to theoretical discourse but also to actionable strategies for fostering inclusive digital ecosystems. The co-production of knowledge between academia and practice-oriented stakeholders ensures that recommendations are both empirically grounded and practically implementable.

6. Conclusion

Through the Mode 2 framework, the SEM-PLS results show that QR digital payment innovation is not only determined by technological factors but is also greatly influenced by the socio-cultural context and user experience. The knowledge formed is practical, applicable, and developed through real interactions, making this study an important contribution to the literature on context-based and collaborative innovation.

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