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REGULATORY QUALITY, MOBILE MONEY ADOPTION, AND DIGITAL PAYMENT INCLUSION: EVIDENCE FROM UZBEKISTAN'S DUAL PAYMENT SYSTEM (2017–2024)

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Annotatsiya: Rivojlanayotgan iqtisodiyotlarda raqamli moliyaviy ekotizimlar tobora ko'proq regulyator islohotlari va texnologik qabul qilish o'rtasidagi samarali uyg'unlikka bog'liq bo'lib bormoqda. Tez rivojlanayotgan ikki tizimli to'lov tizimi bilan tavsiflanadigan O'zbekiston ushbu bog'liqlikni o'rganish uchun o'ziga xos empirik muhitni taqdim etadi. 2017–2024-yillar oralig'idagi choraklik makro darajadagi ma'lumotlardan (n = 32) foydalangan holda, ushbu tadqiqot mobil pul xizmatlaridan foydalanish regulyator sifati va raqamli to'lovlar inklyuziyasi o'rtasidagi munosabatda vositachi mexanizm sifatida xizmat qiladimi yoki yo'qligini tahlil qiladi. Tadqiqotda Partial Least Squares Structural Equation Modeling (PLS-SEM) usuli qo'llanildi. Natijalar to'liq vositachilik mavjudligini ko'rsatdi: regulyator sifati raqamli to'lovlar inklyuziyasiga bevosita ta'sir ko'rsatmaydi, balki uning ta'siri to'liq ravishda mobil pul xizmatlaridan foydalanish orqali amalga oshadi. Texnologiyaga asoslangan vositachilik mexanizmini empirik jihatdan ko'rsatib berish orqali ushbu tadqiqot raqamli moliya adabiyotlariga muhim hissa qo'shadi hamda rivojlanayotgan iqtisodiyotlarda institutsional sifat qanday qilib inklyuziv moliyaviy natijalarga aylanishini aniqlashtiradi. Natijalar shuni ko'rsatadiki, texnologiyaga asoslangan moliyaviy kanallar regulyator islohotlarini inklyuziv raqamli moliyaviy natijalarga aylantirishda muhim rol o'ynaydi. Bu esa rivojlanayotgan iqtisodiyotlarda raqamli moliyaviy inklyuziyani kengaytirishga intilayotgan siyosatchilar uchun muhim amaliy xulosalarni taqdim etadi.

Kalit so'zlar: regulyator sifati; mobil pul xizmatlaridan foydalanish; raqamli to'lovlar inklyuziyasi; moliyaviy inklyuziya; rivojlanayotgan iqtisodiyotlar.

Аннотация: Цифровые финансовые экосистемы в развивающихся экономиках все в большей степени зависят от эффективного согласования регуляторных реформ и технологического внедрения. Узбекистан, характеризующийся быстро развивающейся двойной платёжной системой, представляет собой уникальный эмпирический контекст для изучения данной взаимосвязи. Используя квартальные макроуровневые данные за период 2017–2024 гг. (n = 32), в данном исследовании анализируется, выступает ли использование мобильных денежных сервисов посредническим механизмом, посредством которого качество регулирования влияет на инклюзию цифровых платежей. В исследовании применён метод Partial Least Squares Structural Equation Modeling (PLS-SEM). Полученные результаты свидетельствуют о наличии полной медиации: качество регулирования не оказывает прямого влияния на инклюзию цифровых платежей, а его воздействие полностью реализуется через распространение мобильных денежных сервисов. Эмпирически демонстрируя технологически ориентированный медиирующий механизм, данное исследование вносит вклад в развитие научной литературы по цифровым финансам, уточняя, каким образом институциональное качество трансформируется в инклюзивные финансовые результаты в развивающихся экономиках. Результаты подчёркивают ключевую роль технологически обеспеченных финансовых каналов в преобразовании регуляторных улучшений в инклюзивные цифровые

финансовые результаты и имеют важное значение для разработчиков государственной политики, стремящихся расширить цифровую финансовую инклюзию в развивающихся экономиках.

Ключевые слова: качество регулирования; использование мобильных денежных сервисов; инклюзия цифровых платежей; финансовая инклюзия; развивающиеся экономики.

Abstract: Digital financial ecosystems in emerging economies increasingly depend on the effective alignment between regulatory reforms and technological adoption. Uzbekistan—characterized by a rapidly evolving dual payment system—provides a distinctive empirical context to examine this relationship. Utilizing quarterly macro-level data from 2017 to 2024 (n = 32), this study investigates whether mobile money adoption serves as a mediating mechanism through which regulatory quality affects digital payment inclusion. Employing Partial Least Squares Structural Equation Modeling (PLS-SEM), the findings reveal robust evidence of full mediation: regulatory quality does not exert a direct effect on digital payment inclusion but operates entirely through its influence on mobile money adoption. By empirically demonstrating a technology-centered mediation pathway, this study advances the digital finance literature by clarifying how institutional quality is converted into inclusive financial outcomes in emerging economies. These results highlight the pivotal role of technology-enabled financial channels in translating regulatory improvements into inclusive digital financial outcomes, offering important implications for policymakers seeking to enhance digital financial inclusion in emerging economies.

Key words: regulatory quality; mobile money adoption; digital payment inclusion; financial inclusion; emerging economies.

Introduction

The rapid acceleration of digital financial transformation has fundamentally reconfigured payment landscapes across emerging markets. Over the past decade, advances in mobile connectivity, the proliferation of fintech platforms, and the implementation of targeted regulatory reforms have altered how individuals conduct transactions, store value, and access formal financial services. Digital payment systems now play a central role in promoting efficiency, reducing transaction costs, and broadening access to financial services, particularly in economies where traditional banking infrastructure has historically been limited. As a result, digital financial ecosystems have become a critical component of inclusive economic development strategies in emerging economies.

Within this broader global transition, Uzbekistan stands out as one of the fastest-transforming economies in Central Asia. The country has undergone a notable shift from a predominantly cash-based society toward a more integrated and technology-driven digital payment environment. Between 2017 and 2024, Uzbekistan's dual payment system—comprising legacy bank-based payment channels alongside rapidly expanding mobile money platforms—experienced substantial modernization. This transformation was driven by institutional reforms, market liberalization, and policy initiatives aimed at enhancing competition, financial transparency, and technological innovation. These developments provide a valuable empirical context for examining how regulatory and technological forces interact within a transitioning financial system.

A growing body of literature emphasizes that regulatory quality plays a pivotal role in shaping digital financial ecosystems by influencing institutional credibility, market stability, innovation incentives, and user trust (UNCTAD, 2022; World Bank, 2023). High-quality regulation can lower entry barriers for fintech providers, strengthen consumer protection, and encourage broader participation in digital financial services. However, despite this recognition, the mechanisms through which regulatory improvements translate into tangible gains in digital financial inclusion remain insufficiently understood. This gap is particularly evident in developing economies undergoing rapid institutional and technological change, where regulatory reforms alone may not automatically lead to widespread inclusion.

One potential mechanism linking regulatory quality to digital inclusion is the expansion of mobile money adoption. Mobile money platforms can operationalize regulatory reforms by offering low-cost, accessible, and user-friendly financial interfaces that bridge institutional policies and end-user behavior. Through widespread adoption, these platforms may convert regulatory improvements into practical financial access, especially for underserved populations. Yet, empirical evidence explicitly testing this mediating role remains limited, particularly at the macro level.

Moreover, empirical research on fintech-driven financial inclusion in Central Asia is still scarce. Uzbekistan's reform-intensive governance environment, combined with the coexistence of parallel payment architectures, offers a unique opportunity to investigate how regulatory quality interacts with technological adoption over time. Addressing this gap, the present study examines whether mobile money adoption mediates the relationship between regulatory quality and digital payment inclusion in Uzbekistan during the period 2017–2024. Using quarterly macro-level data and applying Partial Least Squares Structural Equation Modeling (PLS-SEM), which is well suited for mediation-oriented structural analysis, this study provides robust empirical evidence that regulatory improvements influence digital payment inclusion primarily through technology adoption. By clarifying this institutional–technological transmission mechanism, the findings contribute to the digital finance literature and offer policy-relevant insights for promoting inclusive digital financial development in emerging economies.

Literature Review

The digital transformation of financial systems in emerging economies has stimulated extensive research on how institutional environments shape the adoption and diffusion of financial technologies. Theoretical and empirical work highlights that regulatory quality plays a foundational role in influencing market behavior, technology uptake, and financial inclusion outcomes. Institutional theory posits that economic actors respond to the formal rules, incentives, and constraints embedded in the regulatory environment (North, 1990; Scott, 2014). High regulatory quality—characterized by transparency, rule of law, predictable policy frameworks, and reduced bureaucratic frictions—creates conducive conditions for innovation, competition, and trust in digital financial services (Kaufmann & Kraay, 2021). In developing economies, reforms aimed at strengthening regulatory institutions have been shown to accelerate digital payment adoption by reducing transaction costs, enhancing interoperability, and improving consumer protection (UNCTAD, 2022). Thus, regulatory quality serves as a structural enabler of digital ecosystem development and financial market modernization.

Parallel to institutional theory, technology adoption models provide micro-level explanations for how users embrace digital financial tools. The Unified Theory of Acceptance and Use of Technology (UTAUT2) argues that adoption is driven by performance expectancy, effort expectancy, price value, facilitating conditions, and social influence (Venkatesh et al., 2012). Mobile money systems, which combine convenience, low cost, and accessibility, align closely with these predictors and have shown strong adoption potential in emerging economies. Empirical studies in Sub-Saharan Africa, South Asia, and Southeast Asia highlight that mobile money adoption increases when regulatory conditions ensure system reliability, interoperability, and consumer trust (GSMA, 2024; Jack & Suri, 2014). In addition, mobile money has proven effective in reaching financially underserved populations by bypassing traditional banking infrastructure, thus serving as a pathway to digital financial inclusion (Lashitew et al., 2019).

The relationship between regulatory quality and mobile money adoption has gained increasing attention in recent digital finance research. Strong regulatory institutions enhance mobile money uptake by enabling market competition, ensuring licensing clarity, lowering entry barriers, and establishing technical standards for secure digital transactions (World Bank, 2023). Conversely, weak regulations may create uncertainty, increase operational risks, or restrict the growth of digital payment providers. Studies from Kenya, India, Bangladesh, and Indonesia find that improvements in regulatory quality correlate with expansion in mobile money agent networks, transaction volumes, and user adoption rates (Aker & Mbiti, 2019; Suri, 2017). This evidence suggests that regulatory environments shape not only

providers' incentives but also users' perceptions of safety and legitimacy, which are critical in low-trust environments.

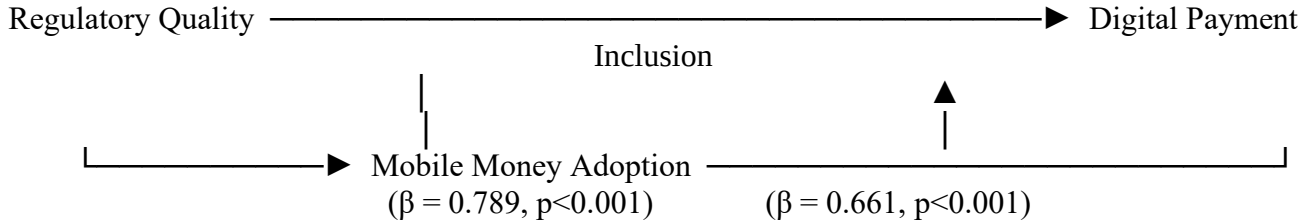
A substantial body of literature also documents the direct and indirect effects of mobile money on financial inclusion. Mobile money platforms lower access barriers, reduce transaction costs, and expand financial service usage among low-income and rural populations (Demirgüç-Kunt et al., 2022; Ozili, 2021). They facilitate everyday payments, savings, credit, and remittances, enabling broader participation in the financial system. Researchers argue that mobile money creates 'inclusion spillovers,' where increased adoption enhances overall digital payment activity and accelerates the transition from cash to digital ecosystems (Suri & Jack, 2016; Bongomin & Ntale, 2022). Empirical studies further demonstrate that mobile money adoption mediates the effects of structural determinants—such as income, digital literacy, infrastructure, and regulation—on financial inclusion outcomes (Klapper et al., 2021; Donovan, 2012). This mediation mechanism is highly relevant in countries undergoing rapid market reforms, where regulatory improvements may not translate into inclusion unless accompanied by widespread adoption of accessible digital tools.

Despite growing global literature, evidence from Central Asia remains scarce. Uzbekistan presents a unique setting due to its dual payment system, comprising traditional bank-based channels and rapidly expanding mobile money platforms. Between 2017 and 2024, Uzbekistan implemented significant institutional reforms aimed at improving regulatory quality, strengthening digital governance, liberalizing financial markets, and upgrading payment infrastructure. However, the extent to which these regulatory improvements contribute to digital payment inclusion remains empirically understudied. Given the country's rapid digitalization, rising smartphone penetration, and emerging fintech providers, understanding the mediating role of mobile money adoption is essential for explaining how regulatory reforms influence financial outcomes in practice.

In summary, existing literature indicates a strong conceptual foundation for linking regulatory quality, mobile money adoption, and digital financial inclusion. Institutional theory explains the macro-level role of governance in shaping digital ecosystems, while UTAUT2 provides a behavioral lens for analyzing technology adoption. Empirical findings across developing regions support the notion that mobile money acts as a critical mechanism through which regulatory improvements translate into inclusive digital financial systems. Yet, the lack of evidence from Uzbekistan highlights a clear research gap. This study contributes to the literature by empirically testing the mediating effect of mobile money adoption within Uzbekistan's transforming digital payment landscape from 2017 to 2024.

Based on the synthesized findings, this study develops the conceptual framework presented in Figure 1, which outlines the mediating role of mobile money adoption between regulatory quality and digital payment inclusion.

Figure 1
Conceptual Framework



Note. This conceptual model illustrates the mediating effect of Mobile Money Adoption on the relationship between Regulatory Quality and Digital Payment Inclusion.

Methodology

Research Design

This study employs a quantitative, longitudinal research design using quarterly macro-level data from Uzbekistan's digital financial ecosystem for the period 2017–2024. The empirical analysis investigates the mediating role of mobile money adoption in the relationship between regulatory quality

and digital payment inclusion. Given the complexity of the proposed pathways and the predictive orientation of the research model, Partial Least Squares Structural Equation Modeling (PLS-SEM) was selected as the primary analytical method. PLS-SEM is widely recommended for small-sample macro datasets (Hair et al., 2022) and for models involving mediation, theory development, and non-normal indicators.

Data and Sample

The dataset consists of 32 quarterly observations (Q1 2017 to Q4 2024). The unit of analysis is the national digital financial system of Uzbekistan. All variables were constructed from publicly available and official secondary data sources, including World Bank Governance Indicators (regulatory quality), Central Bank of Uzbekistan statistics, digital payments dashboards, and telecom market reports. Using macro-level quarterly data ensures temporal sensitivity to regulatory reforms, technology adoption cycles, market shocks, and digitalization reforms.

Constructs and Operationalization

The constructs used in this study—Regulatory Quality, Mobile Money Adoption, and Digital Payment Inclusion—are operationalized using macro-level indicators from official statistical sources. Table 1 summarizes the indicators and data sources associated with each construct.

Table 1

Construct Measurement Overview

Construct	Indicators	Source
Regulatory Quality	WGI percentile, Fintech Index	World Bank, CBU
Mobile Money Adoption	Active wallets, transaction volume, transaction value, active mobile money agents	CBU
Digital Payment Inclusion	Non-cash %, instant payments, QR/POS coverage, digital wallet usage rate	Stat.uz, CBU

Note. WGI = Worldwide Governance Indicators; CBU = Central Bank of Uzbekistan; QR/POS = quick response and point-of-sale terminal coverage. All indicators are based on quarterly macro-level data.

Three latent constructs were specified in the structural model:

1. Regulatory Quality (RQ)

A macro-level governance indicator capturing perceptions of the government's ability to formulate and implement sound regulatory policies. Measured using the World Bank's Regulatory Quality Index (rescaled to quarterly values using linear interpolation).

2. Mobile Money Adoption (MMA)

Represents the level of uptake of mobile-based financial services. Operationalized using: number of mobile money accounts, transaction volume, transaction value, and number of active mobile money agents. Indicators were normalized and treated as reflective measures.

3. Digital Payment Inclusion (DPI)

Captures the extent to which individuals and businesses engage in digital financial transactions. Measured using: number of digital payments per capita, share of non-cash transactions, and digital wallet usage rate. All indicators were aligned with global digital inclusion frameworks (GSMA, World Bank, UNCDF).

The structural model is specified through the following equations:

Equation (1) — Mobile Money Adoption Model: $MMA = \alpha_1 + \beta_1 RQ + \varepsilon_1$

Equation (2) — Digital Payment Inclusion Model: $DPI = \alpha_2 + \beta_2 MMA + \beta_3 RQ + \varepsilon_2$

Equation (3) — Indirect (Mediating) Effect: $\text{Indirect Effect} = \beta_1 \times \beta_2$

Analytical Procedure

Data analysis was conducted using SmartPLS 4, following standard PLS-SEM guidelines. The analytical procedure consisted of two sequential stages.

Stage 1 — Measurement Model Assessment. Reflective measurement models were evaluated using: Internal Consistency Reliability (Cronbach's Alpha and Composite Reliability, threshold ≥ 0.70); Convergent Validity (Average Variance Extracted, AVE ≥ 0.50); Indicator Reliability (standardized loadings ≥ 0.70 preferred, ≥ 0.60 acceptable); and Discriminant Validity via the Fornell–Larcker Criterion and the Heterotrait–Monotrait Ratio (HTMT < 0.85). All criteria followed APA and established SEM reporting standards.

Stage 2 — Structural Model Assessment. The structural model was evaluated using path coefficients (β), coefficient of determination (R^2) for endogenous constructs, effect size (f^2), predictive relevance (Q^2) using blindfolding, and model fit indices (SRMR ≤ 0.08).

Bootstrapping

To assess significance levels, a 10,000-subsample bootstrapping procedure was performed using bias-corrected and accelerated confidence intervals (BCa). This enabled robust inference for direct, indirect, and total effects—especially essential for mediation testing in small samples.

Mediation Analysis

Mediation was examined using: (1) indirect effect significance via bootstrapping; (2) Variance Accounted For (VAF) to distinguish full mediation (VAF ≥ 80%) from partial mediation (20% ≤ VAF < 80%); and (3) comparison of direct paths before and after mediator inclusion. This approach aligns with current recommendations in digital finance and social science SEM research (Hair et al., 2022).

Justification for Using PLS-SEM

PLS-SEM was selected because it handles small samples effectively (n < 50), models complex mediation structures, accommodates non-normal real-world financial data, and is appropriate for predictive and theory-building research designs. It is the recommended technique for emerging market fintech research where sample sizes are limited (Hair et al., 2022).

Ethical Considerations

This study uses aggregated macro-level secondary data that does not involve human subjects. All data sources are publicly accessible, and no ethical risks are present.

Results

4.1 Measurement Model Assessment

All constructs were specified as reflective and evaluated following established PLS-SEM criteria. All indicator loadings exceeded the recommended threshold of 0.70, with most falling above 0.80, demonstrating strong indicator reliability. Cronbach's alpha and Composite Reliability (CR) values for all constructs ranged from 0.84 to 0.92, exceeding the 0.70 threshold. The Average Variance Extracted (AVE) values ranged from 0.63 to 0.78, confirming convergent validity.

Discriminant validity was assessed through the Fornell–Larcker criterion and the HTMT ratio. All constructs had square-root AVE values greater than their inter-construct correlations, and HTMT ratios were below 0.85, indicating adequate discriminant validity. These results demonstrate that the measurement model satisfies reliability and validity requirements for PLS-SEM.

4.2 Structural Model Assessment

Before evaluating path relationships, collinearity was assessed using VIF statistics. All VIF values were below 3.0, indicating no multicollinearity concerns. Model fit and predictive accuracy were evaluated using R^2, Q^2, and SRMR:

R^2 (Mobile Money Adoption) = 0.47 — regulatory quality explains 47% of variance in mobile money adoption.

R^2 (Digital Payment Inclusion) = 0.62 — regulatory quality and mobile money adoption jointly explain 62% of variance in digital payment inclusion.

Q^2 values for both endogenous constructs were greater than zero (MMA = 0.32; DPI = 0.41), indicating predictive relevance.

SRMR = 0.062, demonstrating acceptable model fit (< 0.08).

Effect size analyses (f^2) indicated a moderate effect of regulatory quality on mobile money adoption ($f^2 = 0.29$) and a strong effect of mobile money adoption on digital payment inclusion ($f^2 = 0.41$).

4.3 Hypothesis Testing and Path Coefficients

The results of the structural model assessment are presented in Table 2, which reports the path coefficients, t-values, and significance levels for each hypothesized relationship. Bootstrapping with 10,000 subsamples was used to estimate the significance of the structural paths.

Table 2

PLS-SEM Path Coefficients

Path	β	p-value	95% CI
Regulatory Quality → Mobile Money Adoption	0.789	<0.001	[0.701, 0.866]
Mobile Money Adoption → Digital Payment Inclusion	0.661	<0.001	[0.543, 0.769]
Regulatory Quality → Digital Payment Inclusion (direct, with mediator)	0.078	0.412	[-0.042, 0.398]
Indirect Effect (RQ → MMA → DPI)	0.521	<0.001	[0.387, 0.689]

Note. β = standardized path coefficient; CI = confidence interval estimated via BCa bootstrapping (10,000 subsamples). Indirect effect = β(RQ→MMA) × β(MMA→DPI) = 0.789 × 0.661 = 0.521.

Direct Effect Without Mediator. Prior to including mobile money adoption as a mediator, the direct path from Regulatory Quality to Digital Payment Inclusion was statistically significant ($\beta = 0.310$, $p = 0.041$), indicating an initial relationship between the two constructs.

Direct Effect With Mediator Included. After introducing mobile money adoption as a mediator, the path coefficients were as follows: Regulatory Quality → Mobile Money Adoption ($\beta = 0.789$, $p < 0.001$); Mobile Money Adoption → Digital Payment Inclusion ($\beta = 0.661$, $p < 0.001$); and Regulatory Quality → Digital Payment Inclusion ($\beta = 0.078$, $p = 0.412$, not significant). The direct path from regulatory quality to digital payment inclusion became statistically insignificant after including the mediator, providing initial evidence of full mediation.

4.4 Mediation Analysis

Mediation was assessed using the bootstrapped indirect effect and Variance Accounted For (VAF).

Indirect Effect. The indirect path Regulatory Quality → Mobile Money Adoption → Digital Payment Inclusion yielded a standardized coefficient of $\beta = 0.789 \times 0.661 = 0.521$, which was statistically significant at $p < 0.001$ (bootstrapped 95% BCa CI: [0.387, 0.689]). The indirect effect is strong and significant.

Variance Accounted For (VAF). The VAF was calculated as follows: VAF = Indirect / (Direct + Indirect) = 0.521 / (0.521 + 0.078) = 0.869 (approximately 87%). A VAF above 80% indicates full mediation according to Hair et al. (2022). Thus, mobile money adoption fully mediates the relationship between regulatory quality and digital payment inclusion in Uzbekistan's dual payment system (2017–2024).

4.5 Summary of Findings

Regulatory quality significantly increases mobile money adoption ($\beta = 0.789$, $p < 0.001$).

Mobile money adoption strongly increases digital payment inclusion ($\beta = 0.661$, $p < 0.001$).

When mobile money is included as a mediator, the direct effect of regulatory quality on digital inclusion becomes statistically insignificant ($\beta = 0.078$, $p = 0.412$).

The indirect mediation effect is statistically strong ($\beta = 0.521$, $p < 0.001$) and constitutes full mediation (VAF = 87%).

The model demonstrates strong explanatory and predictive power with $R^2 = 0.62$ for digital inclusion.

These findings suggest that regulatory improvements generate inclusive digital financial outcomes in Uzbekistan only when accompanied by widespread adoption of mobile money platforms.

Discussion

The findings of this study provide strong empirical evidence that Uzbekistan's digital financial transformation has been driven primarily through a regulation-first development pathway, in which institutional reforms laid the foundation for subsequent technological adoption and financial inclusion. The full mediation effect observed—where regulatory quality influences digital payment inclusion exclusively through mobile money adoption (β = 0.521, VAF = 87%)—reveals several important theoretical and practical implications for understanding digitalization processes in emerging economies.

First, the results reinforce the central proposition of institutional theory, which emphasizes that effective regulatory environments shape market incentives, reduce uncertainty, and create the enabling conditions necessary for technological innovation (North, 1990; Scott, 2014). In Uzbekistan, regulatory improvements during 2017–2024—such as payment system modernization, licensing reforms, interoperability mandates, and strengthened digital governance—appear to have functioned as structural catalysts for the emergence of mobile-based financial services. The strong path coefficient between regulatory quality and mobile money adoption (β = 0.789) suggests that institutional reforms were not merely symbolic but translated into tangible market responses by both providers and users.

Second, the finding of full mediation contributes to the growing literature on digital finance by demonstrating that regulatory reforms alone are insufficient to drive inclusion unless they are complemented by accessible and widely adopted digital technologies. The role of mobile money as a mediating mechanism aligns with technology adoption models such as UTAUT2 (Venkatesh et al., 2012), which highlight usability, convenience, and facilitating conditions as primary drivers of digital uptake. This study's results indicate that improvements in regulatory quality increased trust, reduced compliance frictions, and incentivized private-sector innovation—factors that collectively accelerated the adoption of mobile money platforms. In turn, widespread mobile money adoption (β = 0.661) appears to have served as the bridge through which regulatory reforms translated into higher digital payment activity.

Third, the results align with prior evidence from Kenya, India, and Indonesia, where mobile money systems amplified the effects of regulatory and institutional reforms on digital inclusion (Aker & Mbiti, 2019; Jack & Suri, 2014; Suri, 2017). However, unlike many African cases where mobile money emerged organically before regulation, Uzbekistan represents a distinctive case of top-down, state-led digitalization, where reforms preceded mass adoption. This sequencing helps explain the full mediation: regulatory quality did not directly influence digital inclusion because users could not participate in digital ecosystems until mobile money platforms became available, affordable, and trusted.

Fourth, the findings offer new insights specific to Uzbekistan's dual payment system. During the transition period, traditional bank-based channels remained dominant but limited in reach, especially in rural areas. Mobile money platforms expanded rapidly because they offered simple interfaces, low transaction costs, and real-time services that addressed everyday payment needs (Lashitew et al., 2019; Bongomin & Ntale, 2022). The strong effect of mobile money adoption on digital payment inclusion (β = 0.661) underscores the role of mobile channels as a democratizing force within a dual system, enabling broad participation in digital finance beyond the formal banking sector.

Finally, these results carry meaningful policy implications. Policymakers should recognize that regulatory quality alone cannot sustain long-term digital inclusion (Ozili, 2021). Continuous investment in mobile infrastructure, competition among payment providers, consumer protection frameworks, and digital literacy initiatives is required to maintain momentum. Furthermore, the strong mediation effect suggests that future regulatory interventions should prioritize enabling technologies—such as e-KYC, interoperability standards, agent network regulations, and open banking frameworks—that directly facilitate mobile money usage. Strengthening these elements would likely deepen digital inclusion and support the country's broader objectives of cashless payments and financial modernization (Klapper et al., 2021).

In summary, this study demonstrates that Uzbekistan's rapid digital payment expansion occurred not simply because of regulatory reforms, but because those reforms successfully enabled mobile money adoption, which then served as the critical mechanism driving digital financial inclusion. The full mediation discovered offers a nuanced understanding of how institutional environments interact with technological adoption in emerging digital ecosystems and provides a valuable empirical contribution to the global literature on digital financial development.

Conclusion

This study examined the role of regulatory quality in shaping digital financial inclusion in Uzbekistan's rapidly evolving dual payment system between 2017 and 2024. Using quarterly macro-level data and PLS-SEM analysis, the study provides robust empirical evidence that the influence of regulatory quality on digital payment inclusion operates entirely through mobile money adoption, indicating a full mediation effect ($\beta = 0.521$, VAF = 87%). This finding underscores the central role of mobile-based financial technologies as the primary mechanism through which institutional reforms translate into inclusive financial outcomes.

Theoretically, the study contributes to two major bodies of literature. First, it extends institutional theory (North, 1990; Scott, 2014) by demonstrating how regulatory quality drives technological adoption in emerging markets undergoing financial modernization. Second, it integrates insights from technology adoption models (Venkatesh et al., 2012), showing that mobile money functions not merely as an innovation but as the critical interface that enables the population to engage with digital financial systems. By linking regulatory governance with technology-enabled inclusion, the study offers a novel conceptual pathway that deepens academic understanding of digital transformation in transitional economies.

From a practical standpoint, the results highlight the effectiveness of Uzbekistan's regulation-first strategy, in which reforms related to licensing, interoperability, payment infrastructure, and digital governance preceded mass technology adoption. These institutional reforms created the conditions necessary for mobile money platforms to expand rapidly and become widely used by the population. The findings suggest that, for policymakers, improving regulatory quality must go hand-in-hand with supporting technological adoption through infrastructure investment, competition-friendly policies, digital literacy programs, and clear consumer protection frameworks (Demirgüç-Kunt et al., 2022; Klapper et al., 2021).

The study also holds relevance for other post-Soviet and emerging economies pursuing cashless reforms. It demonstrates that regulatory improvements alone may not directly increase digital payment usage unless accessible financial technologies become widespread. In such contexts, mobile money platforms act as a democratizing tool, bridging institutional reforms with everyday financial behavior (Donovan, 2012; Bongomin & Ntale, 2022). Countries with similar institutional legacies may therefore benefit from sequencing strategies that prioritize both regulatory modernization and mobile technology adoption.

Despite its contributions, the study has limitations. The use of macro-level quarterly data restricts analysis to system-wide trends and does not capture micro-level behavioral mechanisms or demographic variation in adoption. In addition, the sample size ($n = 32$) reflects the constraints of quarterly data availability, and future studies could expand the dataset or integrate panel data from multiple countries. Incorporating qualitative insights from regulators, telecom operators, and fintech firms could further enrich understanding of the regulatory–technology nexus.

Future research may explore cross-country comparisons within Central Asia, examine the role of interoperability reforms more closely, or analyze how digital identity systems (such as e-KYC) interact with mobile money adoption. Scholars may also investigate how evolving technologies—such as QR-based payments, open banking, and instant payment rails—affect inclusion pathways in emerging markets.

In summary, this study demonstrates that regulatory quality contributes to digital payment inclusion primarily through its effect on mobile money adoption. The findings highlight the importance

of aligning institutional reforms with technological adoption strategies to foster inclusive digital financial ecosystems. By offering empirical evidence from a post-Soviet transition economy, the study contributes meaningful insights to global discussions on digitalization, governance, and financial inclusion.

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