The Effect of Institutional Quality and ICT on Financial Inclusion: Evidence from OIC Countries

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ABSTRACT

This study explores how institutional quality and ICT influence financial inclusion in OIC countries. This setting is particularly relevant because many member states show relatively low levels of financial inclusion and face significant disparities in institutional capacity, digital infrastructure, and financial system development. Using panel data for 20 OIC countries from 2016 to 2023, the study constructs composite indices of financial inclusion, institutional quality, and ICT through Principal Component Analysis and estimates a random-effects model selected through the Chow, Hausman, and Lagrange multiplier tests. The results show that institutional quality has a positive and significant effect on financial inclusion, whereas ICT has no significant direct effect. Unemployment reduces financial inclusion, while financial deepening improves it. The interaction between institutional quality and ICT is negative and significant, indicating a weakening or substitution effect: institutional improvements do not automatically amplify ICT benefits and may reduce ICT's marginal contribution when regulation, interoperability, consumer protection, digital literacy, and market readiness remain insufficiently aligned. The study contributes by jointly testing the direct and interaction effects of institutional quality and ICT using multidimensional indices in the underexamined OIC context. These findings support integrated institutional and digital reforms rather than ICT expansion as a standalone strategy.

1. Introduction

Financial inclusion is essential for promoting sustainable growth (Pradhan et al., 2021). Two developmental goals that positively influence social, economic, and environmental progress are financial inclusion and sustainable development (Ozili, 2022). Consequently, numerous researchers are examining the effects of financial inclusion on socio-economic development, encompassing aspects such as poverty, economic growth, gender inequality, income disparity, human development, energy poverty, child poverty, and financial stability (Hussain et al., 2024; Khan & Khan, 2024; Koomson et al., 2024). Financial inclusion refers to the availability of affordable and appropriate financial services, including savings accounts, transactions, credit, and insurance, for individuals and enterprises, provided in a manner that is sustainable and responsible (Pradhan et al., 2021). These financial services support risk management, asset building, and business investment, thereby promoting economic growth and social empowerment (World Bank, 2025)

Nevertheless, the efficacy of financial inclusion is impeded by the disparate levels of financial inclusion across different nations. This setting encompasses OIC member countries in relation to other nations. Data from the Global Findex 2021 indicates that nations in the Middle East and North Africa (MENA) region, which predominantly comprise OIC members, have low levels of bank account ownership. Approximately 48% of adults in the area have a bank account, significantly lower than the developing-country average of 71% (World Bank, 2021). OIC countries experience faster growth in financial infrastructure than the world average. The quantity of bank branches and ATMs in OIC countries increased by 8% and 20% annually, respectively, surpassing the global norms of 4% and 11%. Nevertheless, despite progress, the overall level of financial inclusion remains lower than in other regions, such as East Asia and the Pacific (World Bank, 2021).

Furthermore, numerous studies indicate that barriers to advancing financial inclusion diminish its significance. The primary obstacles can be categorized into four groups: (1) social, macroeconomic, and infrastructural characteristics; (2) institutional quality; (3) banking-related impediments; and (4) regulatory distortions (Vo, 2024). Ali et al. (2022) identified institutional quality as the primary determinant among OIC member countries. High institutional quality, encompassing government effectiveness, law enforcement, and regulatory stability, significantly contributes to enhancing financial inclusion and the development of the financial sector in OIC countries. Superior institutional quality can foster an environment conducive to the creation of an inclusive financial sector (Ali et al., 2022).

Although previous studies have demonstrated the importance of institutional quality for financial inclusion in OIC countries (Ali et al., 2022), existing literature mainly examines institutional factors or macrofinancial determinants like economic growth, banking stability, competition, remittances, trade openness, government debt, and inflation in isolation (Akasumbawa et al., 2024; Zainorin et al., 2023). Meanwhile, evidence on the role of ICT in expanding financial inclusion has primarily been derived from countries or regional groups outside the OIC context (Bayar et al., 2021; Kasradze, 2020; Liu et al., 2023; Nasreen et al., 2025; Njanike & Mpofu, 2024; Yan et al., 2024). Consequently, limited evidence is available on whether ICT independently promotes financial inclusion in OIC countries and whether its effectiveness depends on the quality of national institutions. This gap is particularly relevant because OIC countries differ substantially in institutional capacity, digital infrastructure, income levels, regulatory readiness, and financial-system development.

This study addresses this gap by jointly examining the effects of institutional quality and ICT on financial inclusion in 20 OIC countries during 2016–2023. Its main contribution is to go

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beyond evaluating institutional and technological factors separately by examining if institutional quality influences the link between ICT and financial inclusion. Furthermore, the study develops multidimensional indices for financial inclusion, institutional quality, and ICT through Principal Component Analysis (PCA), enabling a more comprehensive representation of these concepts compared to single-indicator measures. This integrated approach provides more nuanced evidence on whether digital development complements institutional reform or whether misalignment between technology, regulation, and institutional readiness limits ICT's ability to expand inclusive financial access.

2. Literature Review

Institutional Quality and Financial Inclusion

Multiple prior studies have explored how institutional quality impacts financial inclusion. They consistently concluded that improving institutional quality would foster increased financial inclusion. Vo (2025) determined that enhancing institutional quality is crucial for achieving financial inclusion in Asia-Pacific nations, particularly in high-income countries, in the long run. Not all medium- or lower-income countries can recognize the effects of institutional quality. The effect of institutional quality on financial inclusion differs depending on a country's income level (Van et al., 2022; Vo, 2024).

Institutional quality is acknowledged as a crucial factor affecting financial inclusion nationwide, as evidenced by Muriu (2020) and Bawuah (2024). On a broader level, consistent results were also found in research by Zeqiraj et al. (2022) across 73 developing countries; Nsiah and Tweneboah (2023) in developing countries in Africa; and Ha and Nguyen (2023) and Nasreen et al. (2025) in Asian countries, all of which yielded similar findings. Consequently, institutional quality substantially contributes to financial inclusion by enhancing public trust, mitigating corruption, and providing a secure financial system (Nsiah & Tweneboah, 2023).

Financial inclusion is expected to grow significantly in line with the development of robust financial markets and improved institutional quality (Abor et al., 2024). The correlation between political institutions and financial inclusion exhibits a U-shaped pattern. Enhancing institutional quality and democratizing institutions can, in turn, promote financial inclusion (Lachebeb et al., 2020). Poor institutional quality, characterized by inadequate control of corruption, undermines the attainment of financial inclusion (Corrado, 2020; Ouechtati, 2023).
H_1: Institutional quality has positive influences on financial inclusion

ICT and Financial Inclusion

The progression of information and communication technology (ICT) has been suggested to improve the achievement of financial inclusion. This perspective has attracted scholarly interest in examining the consequences of ICT's promotion of financial inclusion. The use of ICT can enhance financial inclusion, as well as the penetration, availability, and use of financial services (Nasreen et al., 2025). The influence of ICT, facilitated by internet access and mobile devices, significantly advances the growth and expansion of the financial sector (Yan et al., 2024).

The use of ICT and the effective application of mobile money can enhance the efficiency, growth, and accessibility of microfinance institutions, as well as improve loan repayment rates and financial inclusion (Liu et al., 2023). Mobile phones and the internet facilitate direct access to financial services by offering a secure platform for transactions, lowering costs, and encouraging a competitive market environment (Bayar et al., 2021). Internet access enables individuals to use online financial services and obtain essential information to open a financial

institution account (Kasradze, 2020). Possessing a cell phone increases the likelihood of making a financial investment compared with individuals without one. Mobile phones facilitate access to banking and financial services, regardless of distance or inconvenience, enabling users to use formal financial services effortlessly (Njanike & Mpofu, 2024). Thus, we can conclude that ICT has the potential to increase financial inclusion.

H_2: ICT positively influences financial inclusion

3. Research Method

The study uses a quantitative method to examine how institutional quality and information and communication technology (ICT) affect financial inclusion progress in 20 OIC member countries, namely Albania, Algeria, Azerbaijan, Bangladesh, Bosnia and Herzegovina, Djibouti, Egypt, Guinea, Indonesia, Kenya, Malaysia, the Maldives, Mauritius, Mozambique, Pakistan, Saudi Arabia, Suriname, Türkiye, the United Arab Emirates, and Uzbekistan. This analysis utilizes secondary data from each country, sourced from the Finance Survey Access (FSA) and the World Development Indicators (WDI), for the period 2016-2023. This research utilizes the financial inclusion index as the dependent variable, with institutional quality and ICT as independent variables, while controlling for GDP per capita, inflation, unemployment, and financial deepening. The characteristics and indicators included in this investigation are enumerated in Table 1.

Financial Inclusion Measurement

This study examines financial inclusion through various indicators, including the density of bank branches per km^2, the ratio of bank branches to the population, the density of ATMs per km^2, the ratio of ATMs to the population, the number of deposits per capita, and the number of borrowers in financial institutions per capita. The six indicators are combined to form a financial inclusion index, computed using principal component analysis (PCA), as demonstrated by Jima and Makoni (2023) and Nyarko et al. (2023). The International Monetary Fund (IMF) provided data for each indicator through the Finance Access Survey (FAS).

Institutional Quality Measurement

Institutional quality is assessed using several key factors: rule of law, corruption control, political stability, absence of violence and terrorism, government effectiveness, regulatory quality, and voice and accountability. These six indicators are combined into composite measures of institutional excellence through principal component analysis (PCA). The data for each indicator are sourced from the World Bank's World Development Indicators (WDI) database.

Information and Communication Technology (ICT) Measurement

The ICT assessment encompasses several indicators, including the proportion of people with internet access, mobile subscription rates, and mobile subscriptions per 100 inhabitants. We applied PCA to combine these three indicators into a single ICT index. Data for all indicators are sourced from the World Bank's World Development Indicators (WDI) database.

Control Variable

This study employed control variables, including per capita income (expressed in natural logarithms), inflation rate, unemployment rate, and financial deepening. Data for each indicator was sourced from the World Development Indicators (WDI) provided by the World Bank.

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Table 1. Variable Measurement

Variable	Indicator	Code	Source
Dependent			
Financial Inclusion	Financial Inclusion Index	FII	FSA IMF (Index calculated using PCA)
Independent			
Institutional Quality	Institutional Quality Index	IQ	WDI (Index calculated using PCA)
Information and Communication Technology	Information and Communication Technology (ICT) Index	ICT	WDI (Index calculated using PCA)
Control Variables			
Income	GDP per capita (constant 2015 US$) in natural logarithms	LGDPPC	WDI
Inflation	Inflation rate as measured by consumer prices (annual %)	INF	WDI
Unemployment	Unemployment rate as a percentage of the total labor force	UNEM	WDI
Financial Deepening	Private sector domestic credit as a percentage of GDP	FINDEEP	WDI

The data were analyzed using panel data analysis (Chatterjee, 2020; Omar & Inaba, 2020). In this study, the best model was selected using the Chow test, the Hausman test, and the Lagrange Multiplier Test. The panel data model used is as in equation (1).

$$FII_{i,t} = \alpha_0 + \beta_1 IQ_{i,t} + \beta_2 ICT_{i,t} + \beta_3 LGDPPC_{i,t} + \beta_4 INF_{i,t} + \beta_5 UNEM_{i,t} + \beta_5 FINDEEP_{i,t} + \varepsilon_i, \quad \text{..... (1)}$$

FII stands for the Financial Inclusion Index; ICT stands for the Information and Communication Technology Index; LGDPPC refers to GDP per capita; INF indicates inflation; UNEM signifies unemployment; FINDEEP pertains to financial deepening; and the symbol denotes the standard error. Following the baseline estimation, we conducted a robustness check by examining the interaction between institutional quality (IQ) and ICT to evaluate how this affects financial inclusion. Additionally, we incorporated dummy variables to classify countries by national income level into four groups: high-income, upper-middle-income, lower-middle-income, and low-income. The estimation equation is presented in equation (2).

$$FII_{i,t} = \alpha_0 + \beta_1 IQ_{i,t} + \beta_2 ICT_{i,t} + \beta_3 LGDPPC_{i,t} + \beta_4 INF_{i,t} + \beta_5 UNEM_{i,t} + \beta_6 FINDEEP_{i,t} + \beta_7 (IQ_{i,t} \times {}_2 ICT_{i,t}) + \beta_8 DC_{i,t} + \varepsilon_i, \quad \text{.....(2)}$$

4. Results and Discussion

Results

Descriptive statistics

Table 2 provides a breakdown of the statistical descriptions of the utilized variables. The range of the financial inclusion index is from -0.52 to 4.90. The results demonstrate differences in financial inclusion levels among OIC member countries. The Maldives has a financial inclusion level exceeding 4. Conversely, certain nations exhibit diminished levels of financial inclusion, with a minimum value of -0.52. The scores for institutional quality vary from -1.33 to 2.58, while the ICT scores range from -0.67 to 4.34.

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Table 2. Summary of Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FII	160	-2.96E-09	1.000001	-0.5286131	4.9001
IQ	160	-1.36E-09	1.000002	-1.332807	2.581724
ICT	160	3.66E-09	1.000002	-0.6731327	4.343915
LGDPPC	160	8.437112	1.054902	6.090155	10.81776
INF	160	8.634699	12.74554	-2.093333	72.30884
UNEM	160	7.890169	5.742166	1.64	27.713
FINDEEP	160	40.59701	27.35315	7.234563	133.817

Source: Author calculation (2026)

Correlation Matrix

Table 3 shows the correlation matrix derived from pairwise correlation analysis. The correlation coefficient ranges from -1 to 1, with 1 indicating a perfect positive relationship, -1 a perfect negative relationship, and 0 signifying no correlation. A positive correlation indicates that the variables generally increase together, whereas a negative correlation suggests they change in opposite directions (Wani et al., 2024). Table 3 shows a positive correlation of 0.21 between institutional quality and the financial inclusion index.

Table 3. Correlation Matrix

Variables	FII	IQ	ICT	LGDPPC	INF	UNEM	FINDEEP
FII	1						
IQ	0.2151	1					
ICT	-0.0958	-0.1075	1				
LGDPPC	0.3068	0.831	-0.1592	1			
INF	-0.1726	-0.1102	-0.0193	-0.0653	1		
UNEM	-0.1767	-0.1565	-0.2631	-0.0162	-0.0171	1	
FINDEEP	0.208	0.7156	-0.0641	0.5918	-0.1912	-0.1409	1

Source: Author calculation (2026)

Our results show that better institutional quality is associated with increased financial inclusion in OIC member nations. Unfortunately, the ICT value showed a negative correlation with financial inclusion (- 0.09). This suggests that improvements in ICT may significantly reduce financial inclusion. Per capita income exhibits a positive correlation, while inflation and unemployment show negative correlations; financial deepening is positively associated with financial inclusion.

Variance Inflation Factor (VIF)

This study employs multicollinearity testing using the variance inflation factor (VIF). It utilizes a VIF threshold value of 10. If the VIF exceeds 10, it indicates multicollinearity.

Table 4. Multicollinearity test

Variable	VIF	1/VIF
IQ	4.5	0.222359
LGDPPC	3.4	0.293842
FINDEEP	2.11	0.47399
UNEM	1.16	0.862619
ICT	1.11	0.902029
INF	1.05	0.955687

Source: Author calculation (2026)

Estimation Results

Table 5 presents the results of the panel data analysis using the Ordinary Least Squares (OLS), Fixed Effects (FE), and Random Effects (RE) models. Following the three panel data

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models, tests were conducted to identify the optimal model using the Chow, Hausman, and Lagrange Multiplier tests. Table 6 indicates that the Random Effects (RE) model was identified as the preferred option according to the three most effective model selection criteria. Consequently, this study draws on findings from RE model analysis. The evaluation results using the RE model in Table 5 demonstrate that the quality of the institution variable (IQ) has a substantial and beneficial effect on financial inclusion. This outcome aligns with the hypothesis (H_1) that institutional quality positively influences financial inclusion.

Table 5. Data Panel Results

Variables	(1) OLS	(2) RE	(3) RE
IQ	-0.307**	0.391***	0.354***
	(0.155)	(0.082)	(0.079)
ICT	-0.113	0.069	0.058
	(0.0771)	(0.145)	(0.122)
lGDPPC	0.466***	0.209	0.135
	(0.128)	(0.127)	(0.109)
INF	-0.013**	0.004*	0.003
	(0.005)	(0.002)	(0.002)
UNEM	-0.041***	-0.0215	-0.021*
	(0.013)	(0.013)	(0.012)
FINDEEP	0.002	0.008***	0.006**
	(0.003)	(0.003)	(0.002)
Constant	-3.581***	-1.981*	-1.274
	(1.079)	(1.173)	(1.020)
Observations	160	160	160
R-squared	0.180	0.224	
Number of countries		20	20

*** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.

Source: Author's calculation (2026)

Conversely, ICT exerts less influence on inclusiveness. This outcome refutes the hypothesis (H_2) that ICT positively influences financial inclusion. The results show an anomaly: ICT can generally increase financial inclusion, but this study finds the opposite, which will be explored further in the discussion. Unemployment and financial depth are two essential control variables that significantly influence financial inclusion. Unemployment largely hinders it, indicating that higher unemployment rates can decrease financial inclusion. Additionally, research shows that financial deepening significantly and positively influences financial inclusion. Therefore, increasing financial deepening can further improve financial inclusion. Simultaneously, GDP per capita and inflation exert no substantial influence.

Table 6. Best model selection

Chow Test (prob)	Hausman Test (prob>chi2)	Lagrange Multiplier (Prob > chibar2)
0.0000	0.3425	0.0000

Source: Author's calculation (2026)

Robustness test

Table 7 displays the results of the robustness check conducted with the random-effects model. This test assesses how institutional and ICT quality attributes affect country classifications based on income levels—high, upper-middle, lower-middle, and low income. The findings indicate that institutional quality consistently positively influences financial inclusion, while ICT quality does not show a significant effect in any of the models.

Table 7. Robustness test by Interaction and dummy of countries' income (RE)

Variables	(1)	(2)	(3)	(4)	(5)
IQ	0.320***	0.376***	0.353***	0.374***	0.357***
	(0.078)	(0.081)	(0.079)	(0.080)	(0.079)
ICT	0.103	0.023	0.052	0.0556	0.061
	(0.121)	(0.116)	(0.121)	(0.122)	(0.123)
LGDPPC	0.078	0.192*	0.111	0.173	0.134
	(0.109)	(0.109)	(0.111)	(0.113)	(0.110)
INF	0.002	0.003	0.003	0.004	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
UNEM	-0.024**	-0.021*	-0.022*	-0.0225*	-0.021*
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
FINDEEP	0.005**	0.006**	0.006**	0.007**	0.006**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
IQ x ICT	-0.209***				
	(0.073)				
High-Income		-1.679**			
		(0.712)			
Upper-Middle Income			0.475		
			(0.488)		
Low-Middle Income				0.253	
				(0.211)	
Low-Income					-0.322
					(0.832)
Constant	-0.758	-1.591	-1.232	-1.703	-1.234
	(1.025)	(0.991)	(1.015)	(1.078)	(1.047)
Observations	160	160	160	160	160
Number of countries	20	20	20	20	20

*** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.

Source: Author's calculation (2026)

The findings suggest that the model aligns with the baseline regression employing the Random Effects (RE) model. The regression results for dummy factors based on national income indicate that the role has a significant impact only on high-income nations. Despite the unfavorable results, they indicate that increased state revenue diminishes the achievement of financial inclusion. The findings support the claim that financial inclusion is more common in high-income countries compared to medium- and lower-income nations. Furthermore, the findings show that the interaction between IQ and ICT significantly negatively impacts financial inclusion.

Discussion

The Effect of Institutional Quality on Financial Inclusion

The analysis shows that better institutional quality (IQ) positively and significantly influences financial inclusion. This suggests that enhancing institutional quality can lead to greater financial inclusion. These findings align with earlier research demonstrating that better institutional quality can improve financial inclusion (Ha & Nguyen, 2023; Nsiah & Tweneboah, 2023; Van et al., 2022; Zeqiraj et al., 2022). These findings support the law and finance theory, where property rights protection, legal certainty, contract enforcement, and predictable regulation are prerequisites for the development of financial markets that are able to serve a wider range of communities (Ahad & Imran, 2023; Jima & Makoni, 2023). When government agencies are able to carry out their supervisory, regulatory, and law enforcement functions

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consistently, the risks faced by financial institutions in providing services to low-income communities and small business actors can be mitigated (Kassi et al., 2023). Thus, institutional quality serves as the foundation linking the development of the financial sector to the expansion of access to, availability of, and utilization of formal financial services.

The first mechanism reduces information asymmetry between financial institutions and potential users of financial services. Effective governance, a strong legal system, and adequate credit reporting regulations can increase the availability and reliability of information about prospective customers' identities, ability to pay, and credit history (O. O. Olaoye et al., 2025; Sanga & Aziakpono, 2023). More accurate information helps banks and financial institutions assess credit risk more objectively so they don't have to limit services to customers who already have assets, collateral, or long-term relationships with financial institutions (Jima & Makoni, 2023). The decrease in uncertainty can increase financial institutions' willingness to open accounts, provide microcredit, and offer financial products to previously underserved or underserved community groups.

The next mechanism operates by reducing transaction costs and strengthening contract certainty. Institutions that are able to protect property rights and effectively enforce agreements can reduce the risk of default, dispute resolution costs, and administrative costs that must be borne by financial institutions and customers (Jima & Makoni, 2023). The reduction in costs allows financial institutions to offer products with simpler terms, lower service costs, and a wider range of services for poor households, micro-enterprises, and informal sector players (Kassi et al., 2023). Conversely, weak contract enforcement encourages financial institutions to implement stricter interest, guarantees, and verification procedures to compensate for high institutional risks, thereby inhibiting the participation of vulnerable groups in the formal financial system (Akintunde & Aribatise, 2022).

Institutional quality also improves financial inclusion by creating consistent, credible, and predictable regulations. Good regulatory quality reduces policy uncertainty and provides clarity on licensing, consumer protection, operational requirements, and supervision of banks, microfinance institutions, and fintech companies (Abaidoo & Agyapong, 2023). This certainty provides incentives for financial service providers to make long-term investments, develop service networks, and reach areas or community groups that were previously considered less profitable (Boussaidi & Hakimi, 2025; Mimoun et al., 2025). In addition to expanding access, effective oversight can maintain the stability of the financial system and prevent exploitative practices, fraud, and excessive risk-taking that can harm financial services users (Kassi et al., 2023).

On the demand side, institutional quality can increase public trust in formal financial institutions. Low levels of corruption, effective governance, strong rule of law, and adequate consumer protections increase the perception that users' funds, identities, and transactions will be managed securely and fairly (Asongu et al., 2021; Bibi et al., 2024). This trust is important because the availability of financial services does not automatically result in use if people still doubt the security of deposits, cost transparency, or complaint resolution mechanisms (Azimi, 2022). When people have confidence in the legitimacy and accountability of the financial system, they tend to switch from informal mechanisms to bank accounts, formal savings, credit, insurance, and digital payment services.

Institutional quality further plays a supporting role in determining the effectiveness of information technology and financial innovation in increasing financial inclusion. Digital infrastructure, mobile banking, and financial technology do not always result in expanded inclusion if they are not accompanied by clear regulations, data protection, cybersecurity,

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customer identification mechanisms, and supervision of digital service providers (Kebede et al., 2023; Mimoun et al., 2025). Under strong institutional conditions, technology can lower distribution costs, speed up transactions, and expand the reach of financial services to remote areas and low-income groups (O. O. Olaoye et al., 2025). However, in weak institutional conditions, digitalization can present new risks in the form of data misuse, digital fraud, hidden costs, and access inequality that ultimately limit the benefits of technology for financial inclusion (Mimoun et al., 2025).

Therefore, mutually reinforcing mechanisms mediate how institutional quality impacts financial inclusion. Reduced information asymmetry and transaction costs increase financial institutions' willingness to provide services, while regulatory certainty, system stability, and consumer protection increase public trust and willingness to use these services. At the same time, strong institutions enable the safe, efficient, and sustainable use of financial technology and innovation. Therefore, institutional quality not only directly affects financial access but also creates the conditions that enable financial policies, infrastructure, and innovation to drive broader, more equitable increases in financial inclusion.

The Effect of ICT in Promoting Financial Inclusion

The analysis reveals that ICT doesn't significantly impact financial inclusion. This suggests that upgrading ICT alone cannot automatically boost financial inclusion in OIC countries. The results are not in line with previous research that states that improving ICT can increase financial inclusion (Alom et al., 2022; Bayar et al., 2021; Kasradze, 2020; Liu et al., 2023; Njanike & Mpofu, 2024). This implies that technology is essentially just a means to an end, whereas people's ability to access, use, and derive real benefits from digital financial services is determined by broader supporting conditions. The availability of mobile phones, internet, banking applications, or digital wallets is not always followed by the availability of a stable telecommunication network, affordable internet costs, a reliable payment system, an adequate network of agents, and interoperability between financial institutions, especially in rural areas and disadvantaged areas (Kouladoum et al., 2022; Mugisha, 2024). As a result, increased ICT penetration can expand the administrative presence of financial services, but not necessarily expand the use of such services by groups previously unreached by formal financial systems (Amari & Anis, 2021).

The limitations of digital literacy and financial literacy also cause some people to be unable to operate applications, understand transaction costs and risks, maintain the security of personal data, or choose financial products that suit their needs (Banik & Roy, 2023). This condition means that access to technology does not always translate into active, safe, sustainable, and productive use of financial services. These barriers tend to be greater among low-income communities, those with limited education, the elderly, women, and rural residents because these groups often face limitations in devices, skills, income, and social support in adopting digital services (Antonijević et al., 2021; Mashapure et al., 2026). Thus, ICT can even widen the financial gap when the benefits of technology are more enjoyed by communities that already have bank accounts, education, income, digital devices, and better connectivity compared to groups that have been excluded from the start (Kuang et al., 2025).

Trust in technology and financial institutions also determines the success of digital financial services because concerns about fraud, data leaks, transaction errors, misuse of personal information, and low understanding of dispute resolution mechanisms can reduce people's willingness to use ICT-based services (Nova & González, 2023). In addition, the presence of technology cannot replace the role of policies, regulations, and institutional

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capacity in ensuring that digital financial services are affordable, competitive, interoperable, secure, and consumer protection-oriented (Aziz & Naima, 2021; Mouna & Jarboui, 2022). Therefore, when fintech regulations are unclear, consumer protection is weak, market competition is limited, and transaction costs remain high, the expansion of ICT only results in the digitalization of existing financial services, without expanding the participation of underserved groups.

The growth of digital lending without accompanying financial literacy and responsible lending practices can increase the risk of excessive debt, hidden costs, privacy violations, and financial vulnerabilities, ultimately reducing public trust in the formal financial system (O. Olaoye & Zerihun, 2023). The impact of ICT can also appear larger or smaller depending on the financial inclusion indicators used, because an increase in the number of accounts or app registrations does not necessarily indicate an increase in usage frequency, service quality, user welfare, or the community's ability to manage financial risks (Banik & Roy, 2023). Therefore, ICT should be understood as a necessary but not sufficient condition for improving financial inclusion without adequate infrastructure, affordability, literacy, trust, policies, and institutions.

In the context of OIC countries, ICT does not automatically enhance financial inclusion because the levels of economic development, institutional quality, infrastructure availability, regulatory capabilities, and socio-cultural characteristics vary greatly among these countries. Some OIC countries already have relatively advanced digital infrastructure and financial systems, while others still face limitations, including internet connectivity issues, high connectivity costs, low digital device ownership, limited agent networks, and weak payment system integration. As a result, the benefits of ICT for financial inclusion are not evenly distributed (Banna & Alam, 2021; Ezzahid & Elouaourti, 2021; Fadillah, 2021). The disparity has led to digital banking and fintech services developing more easily in urban areas and among middle-income communities, while the poor, rural communities, and remote regions continue to face geographic and economic barriers in accessing formal financial services (Kouladoum et al., 2022). The low levels of digital and financial literacy in several OIC countries also mean that the community is not yet fully prepared to use mobile banking, electronic wallets, digital financing, and fintech platforms safely and productively, even though these services are technically available (Aziz & Naima, 2021). This barrier becomes increasingly complex because disparities in education, age, gender, and region cause unevenness in the community's ability to adopt technology, so the expansion of ICT can lead to selective inclusion concentrated on certain groups.

Additionally, in some OIC countries, social norms and gender role divisions can also limit women's ownership of mobile phones, access to the internet, economic mobility, asset ownership, and financial decision-making, so the availability of digital services does not necessarily eliminate the underlying structural barriers to financial exclusion. Public trust in digital financial services is also influenced by perceptions of technology security, the credibility of service providers, transaction transparency, data protection, and the alignment of products with the social and religious values of the community (Azmeh & Al-Raeei, 2024; Pandey et al., 2022). Some Muslim communities may choose not to use formal financial services if digital products are perceived to contain interest, have unclear contracts, include speculative elements, charge non-transparent fees, or have not demonstrated convincing compliance with Islamic financial principles. In such conditions, the digitization of conventional financial products does not automatically address the voluntary exclusion that arises due to religious considerations. Therefore, the development of ICT must be accompanied by product designs

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that align with Sharia principles, are transparent, easy to understand, and relevant to users' needs (Intan et al., 2023; R. Mehmood & Sadiq, 2010).

The impact of ICT in OIC countries is also limited by weak coordination among the government, monetary authorities, Islamic financial institutions, telecommunications companies, and fintech providers in building an integrated and interconnected digital system. Unclear fintech regulations, weak supervision, a lack of consumer protection, and inconsistent Sharia compliance standards can hinder innovation and reduce public trust in digital financial services (Nam et al., 2025). In addition, the rapid development of digitalization can increase the risk of fraud, cyberattacks, misuse of personal data, irresponsible financing, and excessive debt, especially for communities with limited financial literacy (O. Olaoye & Zerihun, 2023).

The heterogeneity among OIC countries also makes the relationship between ICT and financial inclusion difficult to generalize because increased digital access in one country can boost the use of financial services, while in another country it only increases passive account ownership without improving transactions or user welfare (Banna et al., 2021; Damrah et al., 2022). Therefore, ICT can only have a significant impact on financial inclusion in OIC countries if its development is carried out as part of an ecosystem that integrates digital infrastructure, payment systems, financial and digital literacy, data protection, fintech regulation, women's empowerment, expansion of service networks, and the provision of Sharia-compliant financial products.

The Interaction Effect of IQ and ICT on Financial Inclusion

Negative and notable interactions between institutional quality and ICT for financial inclusion suggest that technological progress alone doesn't always lead to increased financial access unless it aligns with the institutions' capacity, orientation, and preparedness. These findings do not suggest that ICT or institutional quality individually always have a negative impact, but rather reflect a mismatch between technological innovation, regulation, governance, market structure, and the needs of groups that are not yet served by the formal financial system (Rahman et al., 2022; Supriadi et al., 2023). The effectiveness of ICT in enhancing financial inclusion heavily depends on adaptive regulations, system interoperability, inter-agency coordination, consumer protection, and public trust in digital financial services.

Strengthening regulations and supervision that are not designed proportionally can increase licensing requirements, customer identification, reporting, capitalization, and compliance costs for fintech companies and financial institutions (R. M. A. Mehmood et al., 2024). The burden can be passed on to consumers through higher transaction fees, more complex procedures, and service requirements that are difficult for low-income communities to meet. In the context of OIC countries, the complexity increases because digital services must also comply with governance and Shariah compliance. Variations in standards and Shariah oversight mechanisms across countries can heighten legal uncertainty, leading financial institutions to favor groups that are simpler to verify, possess stable income streams, and are integrated into the formal financial system (Rahman et al., 2022).

The negative impacts are also related to disparities in implementation and fragmentation of the digital financial ecosystem. The development of ICT infrastructure, administration digitization, and electronic banking services is often concentrated in urban areas and among high-income groups, so improvements in national technology indicators do not necessarily represent access for rural communities, the poor, women, the elderly, and residents with low education (Aziz & Naima, 2021; Mashapure et al., 2026). In addition, the lack of coordination among banks, fintech, telecommunications companies, microfinance institutions, and Islamic

social financial institutions can result in fragmented platforms, databases, registration procedures, and consumer protection mechanisms. This fragmentation increases switching costs, reduces user convenience, and limits interoperability across financial channels (Ascarya, 2022; Suhartono et al., 2021).

Thus, a negative interaction coefficient reflects a weakening or substitution effect, meaning that when institutional quality improves, it can reduce the additional benefits of ICT for financial inclusion. This condition can occur when institutions prioritize stability, formality, supervision, and compliance over expanding access, while data governance, cybersecurity, consumer protection, digital literacy, payment interoperability, and shariah supervision have not developed adequately. Therefore, institutional quality must be directed toward building a digital ecosystem that is safe, affordable, integrated, and inclusive, so that ICT not only enhances the efficiency of already-served groups but also actively and sustainably expands the use of formal financial services for groups that have previously been excluded.

5. Conclusion

This research analyzes the impact of institutional quality and information and communication technology (ICT) on financial inclusion in 20 OIC member countries between 2016 and 2023. The results, derived from a random-effects model, indicate that institutional quality has a positive and significant influence on financial inclusion. This underscores the importance of good governance, regulatory quality, rule of law, corruption control, and institutional credibility as crucial elements in increasing access to formal financial services. On the other hand, ICT shows no substantial direct impact on financial inclusion. The analysis also indicates that unemployment hampers financial inclusion, whereas financial deepening promotes its development.

The robustness analysis also reveals a significant negative interaction between institutional quality and ICT. This finding does not imply that institutional reform or technological development is inherently detrimental. Rather, it suggests that technological expansion has not yet been adequately aligned with regulatory capacity, institutional orientation, market structure, consumer needs, and the readiness of the digital financial ecosystem across OIC countries. ICT infrastructure alone, like internet access, mobile phones, or digital financial platforms, is not enough to achieve broader financial inclusion. Without affordable connectivity, digital and financial literacy, payment interoperability, effective supervision, data protection, cybersecurity, and public trust, technological development may primarily benefit individuals who are already financially connected, leaving vulnerable groups behind.

Accordingly, governments within OIC countries ought not to pursue the development of ICT infrastructure as a standalone strategy for financial inclusion. Investment in digital connectivity should be implemented alongside institutional reforms, including stronger digital consumer protection, effective anti-corruption measures, transparent fintech regulation, personal data protection, cybersecurity standards, accessible complaint-resolution mechanisms, and proportionate supervision of digital financial providers. Policies should also promote interoperable payment systems, coordination among governments, monetary authorities, telecommunications companies, Islamic financial institutions, and fintech providers, and the development of transparent, Sharia-compliant digital financial products. Such an integrated policy package is particularly important in middle- and low-income countries, where institutional weaknesses, limited literacy, high connectivity costs, and unequal service coverage remain substantial barriers.

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This study is limited by its coverage of only 20 OIC countries, the relatively short observation period, and the use of aggregate national indices that may not fully capture differences in the quality, affordability, intensity, and safety of digital financial-service use. Future research should extend the country and time coverage, distinguish between financial access and actual usage, and incorporate additional determinants such as education, digital and financial literacy, income inequality, gender disparities, rural connectivity, regulatory readiness, and Sharia-compliance arrangements. Further studies may also apply dynamic, nonlinear, or threshold models to identify the institutional conditions under which ICT begins to produce a meaningful and inclusive financial effect.

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