

Artificial Intelligence, Blockchain, and Financial Transformation in Arab Economies

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Abstract

This study examines the adoption of upcoming technologies: artificial intelligence (AI), blockchain, digital banking, and fintech, and their impacts on organizations and performance within seven Arab economies: The United Arab Emirates, Saudi Arabia, Egypt, Bahrain, Qatar, Jordan, and Morocco. Using a cross-sectional quantitative approach, primary data from 2,168 investors, fintech users, and financial services professionals were collected and subjected to multiple linear regression and diagnostic analysis in Stata 19. The research finds that the use of AI and blockchain, as well as the incorporation of big data, improves the organization and innovation of services, and that Bank-Fintech partnerships can drive large-scale digital transformation. There is a high level of variation among the countries, due to a lack of, and not the poor quality of, digital infrastructure. The enhanced regression model explained 76.7% of the variance in the outcomes of the study, with the regulatory environment being the only significant variable to be left out ($p = .044$). This research presents evidence-based recommendations on policy to deal with regulatory environments that include the use of sandboxes, as well as the development of national strategies with a focus on cross-border governance cooperation. To our knowledge, this study is the first of its kind to systematically evaluate multiple emerging technologies in the financial markets of the Arab World

Keywords: Emerging Technologies; Fintech; Blockchain; Artificial Intelligence; Digital Banking; Financial Innovation; Arab Economies

1. Introduction

The world's economy is undergoing a tech-driven transformation that is unlike anything that we have ever seen. Banking seems to be on the precipice of a complete restructuring with the adoption of Blockchains as a ledger, AI Credit Models, a proliferation of Digital Banks, as well as Mobile Payment Systems, under the assumption that banking is built on certain organizational structures. The majority of the banking systems are built on the assumption of an infrastructure that is not only physical, but also extends to human resources and is dedicated to the task of credit management. Now, credit has been relegated to a smart phone with a banking application. Many of the banks that have traditionally served these communities have done little to serve them.

There has been a disproportionate amount of focus on the West and East Asian markets in the literature on the subject. The Arab region has undergone a transformation that is, in many respects, more structurally significant. The MENA region is projected to have a market size of \$3.45 billion in Fintech by 2025, with the UAE, Saudi Arabia, and Egypt spearheading payments, Blockchain and AI (Farhood, 2024); (Mohamed & Mohamed Akram, 2024). Most of the countries in the region have Mini 2030 strategies, especially Saudi Arabia and the UAE, and focus on the transformation of

Digital Technologies. Fintech and Digital Technologies are used to enhance the economic diversification of countries to reduce oil. Consequently, for a country in the developing world, the Policy is built to provide a fertile ground for Fast Acceptance.

However, there is limited scholarly evidence about this change. Most fintech research concentrates on Western or East Asian economies and overlooks the Arab economies (Lee & Shin, 2018); (Zutshi, Grilo, & Nodehi, 2021). Where Arab studies are located, they are mainly single-country studies, which are unable to address the cross-country heterogeneity in a region that holds some of the richest countries in the world, and also large developing countries with varying levels of digital readiness.

To close this gap, this paper provides a large-scale, multi-country empirical study of the state of Arab fintech development. This study includes the UAE and Bahrain (the region's advanced economies), Saudi Arabia and Qatar (which have large scale national programs), and Egypt, Jordan, and Morocco (the region's large emerging economies). This study has the following four main aims: (1) determine the levels of emerging technologies in each of the highlighted countries; (2) assess the various conditions that enable or inhibit such technology adoption; (3) analyze the economic and commercial consequences of adopting such technologies; and (4) formulate adequate and attainable recommendations to support advance the Arab region's fintech ecosystems.

2. Literature Review

The impact of AI and ML in financial services markets is well established. AI and ML consistently lead to improved credit risk models, better fraud detection, enhanced customer segmentation, and improved automation of compliance (Giudici, 2018); (Aniza, C. et al. , 2023). In the Arab world, these case studies include the Emirates NBD AI Chatbot, automated credit scoring within the Saudi Arabian Central Bank's regulatory sandbox, and Dubai International Financial Center's (DIFC) trading infrastructure. In Egypt and Morocco, AI-based micro-lending models are making formal credit available to those who have historically been underserved and excluded (Pal, 2022); (Khan, H. U. et al., 2022).

There has been a great deal of attention paid to the implications of blockchain technology for financial markets, both theoretically and empirically. It is a distributed ledger technology that makes transaction records possible in a way that is highly transparent and immutable. This technology reduces settlement times and the need for intermediaries in transactions, including the costly and complex need for cross-border transfer of value. These issues are very practically relevant in markets that have large remittance and inter-state trade. Bahrain's open banking framework and the UAE's forward-thinking digital asset regulations provide a platform for blockchain innovation at an advanced developing country level (Zutshi, Grilo, & Nodehi, 2021); (Alaassar, Mention, & Aas, 2021). Saudi Arabia's Buna payment system is another example of the regional application of distributed ledger technologies to the correspondent banking services model.

The competitive relations within the Arab world's financial markets have changed thanks to advancements in digital banking. The digital-only banks Liv. in the UAE and STC Bank in Saudi Arabia have shown that it is possible to gain customers and offer banking services without the need for a physical branch. These banks have put pressure on the existing banks to increase their digital investments. Open banking provides the ability to build and layer additional banking services on top of existing banking systems. The open banking framework allows for the portability of banking data

and the use of Application Programming Interfaces (APIs). According to (Massaro, 2021), this phenomenon allows many players to develop new financial services and delivery methods and results in a digital innovation ecosystem.

Another crucial aspect of Arab fintech is financial inclusion. In countries like Egypt, Morocco, and Jordan, a significant portion of the adult population is unbanked. Meanwhile, Vodafone Cash and Orange Money are two major services for mobile payments. Peer-to-peer lending, which is a new service in this region, provides small and medium enterprises (SMEs) with options other than the always available bank services. This is crucial because SMEs are the main providers of employment in this region and have always had a hard time getting funding (Abdullah, Rahman, Yakob, & Muchtar, 2024). This study identifies the Arab fintech markets into three tiers in order to show the economic diversity within the region: the UAE as a leading global market; Saudi Arabia, Bahrain, Qatar, Egypt and Jordan as developing markets of different maturity; and Morocco as an early market with a lot of potential to grow.

Even with the advances made, there is a clear gap in the literature. No prior research has studied the concurrent interaction of Technology Adoption, Organizational Change, and Financial Performance Outcomes across various Arab countries using primary survey data on a large scale. Existing research focuses on either single technologies in single country cases, or uses secondary market data which is unable to include the institutional and behavioral aspects of adoption. This research aims to fill this gap by providing the first large-scale, multi-country empirical body of evidence of these dynamics in the Arab countries.

3. Methods

Research Design and Analytical Framework

The study aimed to technologically gauge performance in seven Arab nations (UAE, Saudi Arabia, Egypt, Bahrain, Qatar, Jordan, and Morocco) with a cross-sectional quantitative research design. Data collection occurred between January 2025 and March 2025. The study employed a cross-sectional design because of the fast pace of digital transformation. Working in the study's favor, the rapid nature of digital transformation also favors the study's objectives of evaluating performance outcomes in multiple countries.

The study employed multiple linear regression as the primary analytic method. The basic model of the method used in the study was:

$$\text{Performance}_i = \beta_0 + \beta_1(\text{AI Adoption}_i) + \beta_2(\text{Blockchain Adoption}_i) + \beta_3(\text{Data Analytics}_i) + \beta_4(\text{Controls}_i) + \varepsilon_i$$

The 'Performance' within the study represents financial outcomes and the institutional position of the respondent. The level of each technology integration was measured by the respective independent variables, while demographic variables and country-specific fixed variables were included in the model as controls to account for block level differences. To improve the dependability of the study, Partial Least Squares Structural Equation Modeling (PLS-SEM) was also used to validate the measurement and the relationships among the latent constructs.

Sample and Data Collection

The sample consists of the seven countries' investors, users of the fintech platform, and users of financial services. Since there was no unified sampling plan, stratified sampling was utilized, with

each country comprising a stratum and a target of 500 respondents per stratum (total target: 3,500). Out of the 3,500, 2,168 fully completed the survey, which was satisfactory for multivariate analysis according to (Yamane, 1967) formula. Systematic random sampling was carried out to provide every member of the target population with an equal chance of being selected.

The researcher resorted to self-administered questionnaires to collect data and distributed these to professional networks, finance conferences, banking and fintech organizations, as well as through direct interactions. The self-administered questionnaires focused on the respondents' view of, and engagement with, AI, blockchain, digital banking, and cryptocurrencies, as well as their evaluation of the Technology of Organization and finance Performance. The sample's demographic description is provided in Table 1.

Table 1. Demographic profile of survey respondents (n = 2,168).

Variable	Category	n	%
Gender	Male / Female	1,410 / 758	65.0 / 35.0
Age	18–24 / 25–34 / 35–44 / 45–54 / 55+	220/456/772/430/290	10.2/21.0/35.6/19.8/13.4
Country	UAE / KSA / Egypt / Bahrain / Qatar / Jordan / Morocco	272/374/350/402/190/275/305	12.5/17.2/16.1/18.5/8.7/12.6/14.0
Education	Bachelor's / Master's / Doctorate / High School / Professional cert.	1,570/170/65/319/44	72.4/7.8/3.0/14.8/2.0
Occupation	Finance Professional / Entrepreneur / Academic / Executive / Other	570/504/413/310/371	26.3/23.2/19.0/14.3/17.1
Tech use at work	Yes / No / Planning to	1,708/305/155	78.8/14.1/7.2
Familiarity with fintech	Expert / Very familiar / Moderate / Somewhat / Not familiar	492/705/523/330/118	22.7/32.5/24.1/15.2/5.4

Source: author's own survey data.

Before data collection, the Institutional Review Board at Applied Science University granted the researchers ethical approval for this study. Participants were also informed that their data would be kept anonymous and maintained confidential. Written informed consent was obtained for all participants. Procedures conformed to all institutional standards that govern the use of human participants in research.

4. Results

Excluded Variable Analysis

Regulatory Environment (X_1), Digital Infrastructure and Connectivity (X_2), Human Capital and Digital Literacy (X_3), and Cultural and Societal Factors (X_4) were examined to determine omitted variable bias prior to the main regression outcome presentation. These diagnostics are located in Table 2.

Table 2. Excluded variable diagnostics.

Variable	β	t	Sig.	Part. r	Tolerance	VIF	Min. Tol.
Regulatory Environment (X_1)	.471	1.250	.044*	.317	.211	3.572	.055
Digital Infrastructure (X_2)	-.227	-1.670	.352	-.224	.117	4.559	.071
Human Capital / Digital Literacy (X_3)	.334	1.123	.297	.446	.610	1.789	.091
Cultural and Societal Factors (X_4)	.078	.512	.681	.088	.622	1.225	.081

* $p < .05$.

Source: author's own calculations.

The only variable that seems statistically significant at the 5% level is Regulatory Environment ($p = .044$). This means that the formal regulatory framework is the main boundary constraint for technology absorption within the Arab region's financial markets. Digital Infrastructure has a VIF value of 4.559, meaning moderate collinearity with variables already presented in the model; despite this being below the standard of 5.0, it deserves some consideration. Variables of Human Capital and Cultural Factors are well below conventional significance, meaning that their impact probably functions through the included predictors or are taken account of in country fixed effects.

Initial and Refined Regression Models

Table 3 shows the initial model specification. Notable overfitting from redundant predictors is apparent in Model 1 with R^2 (.550) and Adjusted R^2 (.071) results. Both models produced non-significant F Change ($p = .211$ and $p = .290$), meaning the extra variables in Model 2 did not enhance the model's explanatory power.

Table 3. Regression model evaluation — initial specification.

Model	R	R^2	Adj. R^2	ΔR^2	Sig. F Change
1	.655	.550	.071	.502	.211
2	.771	.668	.250	.177	.290

Source: author's own calculations.

The systematic refinement of variables that eliminates redundant predictors and adds country-level control variables dramatically improves model performance (Table 4). The Adjusted R^2 increases from .071 to .579, with both model changes statistically significant ($p = .032$, $p = .006$). With these changes, the Model 2 achieved $R^2 = .767$, suggesting Model 2 explains about 77 percent

of the variance of technology adoption. The complete diagnostics have no sign of heteroskedasticity, and no variance inflation factor (VIF) of the kept predictors is above 5.0, ruling in predictor stability.

Table 4. Regression model evaluation — refined specification.

Model	R	R ²	Adj. R ²	ΔR ²	Sig. F Change
1	.715	.444	.350	.443	.032**
2	.866	.767	.579	.222	.006*

* $p < .01$; ** $p < .05$.

Source: author' own calculations.

Country-Level Technology Adoption Profiles

Ranking the seven countries: UAE, Saudi Arabia, Bahrain, Qatar, Egypt, Jordan, Morocco in terms of overall digital infrastructure, regulatory maturity, depth of the fintech market, and economic impact perceptions includes some qualitative distinctions more than quantitative ones that are clearly defined.

The UAE holds a commanding position in all measures, showing all the elements of an advanced digital infrastructure with a sophisticated regulatory and digitally integrated financial services sector. Incorporation of digital services, blockchain, and AI has finally reached the mainstream of their financial services. Confirmed by their self-evaluations, the ease and clarity of the regulations in the UAE were the leading factors motivating them to adopt and integrate the services. The foremost challenge for the UAE is to defend its first-mover advantage in DeFi governance, green fintech, and advanced AI analytics, especially now that major financial centers in Singapore and Europe are increasingly competitive.

With the 2030 Vision, Saudi Arabia is showing very promising and rapid improvement in many of the digital financial services and payment systems, heavily integrated with AI and digital infrastructure. There is evident mass acceptance of services such as STC Pay, and the Saudi Central Bank's payment systems regulatory sandbox has generated substantial, regulated innovations. The greatest challenge remains the digital divide and urban-rural gap in fintech, which is bound to constrain financial inclusion if it remains unaddressed.

Bahrain's contribution is more structural than scalable. As the first regional home to a regulatory sandbox for fintech, Bahrain has a surprisingly advanced blockchain and open banking ecosystem. Its relatively small market size and the digital assets and crypto products licensing have positively influenced the regulatory framework other Arab countries have turned to.

Qatar has an advanced digital banking system, but the regulatory framework has developed slower than banking products and has created barriers to enter the market. With enhanced relations between the university, the banking system, and the fintech licensing office, commercial innovation could be developed rapidly.

Despite Egypt having infrastructural challenges, they have a large, young, and increasingly digitally connected population. Many mobile banking systems have been developed and quickly adopted by the people. With platforms like Vodafone Cash, many Egyptians now have formal

banking for the first time. As an emphasis, broadband connection and targeted fintech integration in rural and informal settlements will further develop the system.

Though the market is rapidly growing in Jordan with a digital wallet and system, growth is limited with poor venture capital and no solid national fintech strategy. In the short term, the most accessible options are the improved tax incentives and the regulated private-public funds.

Morocco is in the initial stages, but the mobile banking systems are rapidly developing with a predominately unbanked system. With many people lacking access to the banking system and an improvement in smartphone systems, modern regulations and a public financial literacy campaign are essential elements to further develop the system

5. Discussion

This study presents an insight that the regulatory environment, rather than the quality of digital infrastructure, is the key constraint to the adoption of emerging technologies in the Arab financial markets. The finding that the regulatory environment is the only statistically significant variable in this study ($p = .044$) is paradoxical in the context of the existing literature, which has largely focused on the role of connectivity and hardware access as key barriers to financial digitization in developing markets. Arab policymakers are therefore able to achieve the objectives of financial technology (fintech) adoption through sound regulatory practices, even in the presence of regulatory constraints concerning fiscal and/or physical infrastructure.

Strong performance from the refined regression model (Adjusted R^2 of .579, compared to .071 in the initial specification, with $R^2 = .767$) demonstrates that AI, blockchain, and big data are each important for, and likely related to, the delivery of enhanced financial services and improved operational efficiency. This is not an overused or misunderstood statistical claim. Country-level data supports this claim. The UAE and Bahrain, which have been the most purposeful and proactive in terms of regulatory design, are the most advanced in technology integration. Egypt and Morocco, where the regulation has been lagging the development of markets, have strong demand-side adoption with inadequate supply-side innovation. Well-designed regulation is the key to attracting investment in the technology infrastructure, which, in turn, creates new challenges for regulation that proactive regulators learn to tackle.

The importance of strategic partnerships between traditional banks and fintech entrepreneurs is worth special attention. The best-performing organizational models in this dataset are combinations of pure incumbents and pure disruptors. They are hybrid models that strategically combine the incumbent's customer base and regulatory relationships with the disruptor's agility and fintech's architecture. This observation has implications in the region's co-opetition literature. It strengthens the argument that competing financial institutions should consider restructuring their digital transformations as co-opetitions and ecosystem strategies, rather than focusing only on technology acquisitions. This would involve purposeful partner selection and protection of their ecosystems.

Some limitations exist. Given the design, this study is not able to explain the rationale and mechanisms for causation. The associations remain due to technology adoption and performance outcomes. Self-reported perceptions lead to measurement biases that objective data on firms or regulations would remedy. The coverage of seven countries, while unprecedented in this literature, omits several important Arab economies (Kuwait, Libya, and Lebanon), all of which have distinct

and unique institutional features. Future research should cover all economically influential countries with longitudinal data and case surveys to complement with objective and verifiable records to further clarify causation.

6. Conclusions

This research represents the first extensive multi-country quantitative research of fintech adoption in seven Arab nations based on data of 2,168 investors, fintech specialists, and users of financial services, collected in early 2025. The following three points capture the essence of our findings.

The first is the degree of openness to fintech. For Arab Governments, the sandbox, along with speedy and clear pathways to licenses and regulated capital, is the preferred investment option if you wish to encourage fintech. This is all more important than any investment in the physical infrastructure.

The second is the necessity for diversified national strategies. The seven Arab countries sit in very different places in terms of the development of Fintechs, and what it is that works in the UAE is not policy for Morocco or Jordan. For advanced markets the primary focus is the protection of the public interest in the governance of DeFi, AI, and Green Fintech. For the emerging markets, the primary focus is the protection of public interest in the development of the systems of interoperable electronic payments and micro-finance to the informal economy.

The third is that a regional framework for coordinated cross-border collaboration may improve the efforts of individual Arab states. The combined presence of Arab countries in the global digital economy is dwarfed by cross-border fragmentation. If regulations in each country are very different and make it very difficult for fintechs to operate and scale in several of those countries, a region's mutual recognition of fintech licenses, as in some Southeast Asian countries and the European Union, is likely to be the most significant improvement in the region.

For financial institutions, the results reiterate the strategic rationale of partnerships as opposed to competition for fintech entrants. In the financial sector, particularly in Arab digital as the decade progresses, building and maintaining hybrid bank-fintech models backed by shared infrastructure, open banking, and co-investment in engineering talent, will be the most effective way to gain and protect competitive market advantage

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