“Integrating financial literacy, regulatory technology, and decentralized finance: A new paradigm in Fintech evolution”

AUTHORS	Jamileh Ali Mustafa

ARTICLE INFO	Jamileh Ali Mustafa (2024). Integrating financial literacy, regulatory technology, and decentralized finance: A new paradigm in Fintech evolution. *Investment Management and Financial Innovations*, *21*(2), 213-226. doi:10.21511/imfi.21(2).2024.17
DOI	http://dx.doi.org/10.21511/imfi.21(2).2024.17
RELEASED ON	Friday, 10 May 2024
RECEIVED ON	Thursday, 01 February 2024
ACCEPTED ON	Monday, 22 April 2024

JOURNAL	"Investment Management and Financial Innovations"
ISSN PRINT	1810-4967
ISSN ONLINE	1812-9358
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
67	3	6

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

Jamileh Ali Mustafa (Jordan)

INTEGRATING FINANCIAL LITERACY, REGULATORY TECHNOLOGY, AND DECENTRALIZED FINANCE: A NEW PARADIGM IN FINTECH EVOLUTION

Abstract

This study investigates the implications of the interaction of financial literacy, regulatory technology, and decentralized finance applications for financial sector development. A two-step analytical regression approach on EViews 10 was used, which performs a one-factor analysis for each variable to identify the individual impact of each factor. A linear FMOLS approach was used to evaluate the cooperative effect of integration. The methodology was implemented on a dataset comprising 2,880 observations from 23 financial institutions in Jordan.

The findings support the hypothesized dynamic interrelations between the essential Fintech factors relevant to the sustainable development of the financial sector, including significant and insignificant factors with the impact of inflation, which provides an adequate understanding of Fintech's evolution. Additionally, the outcomes consider post-2017 regulatory changes that reflect the role of supervision and regulation for the financial sector's flexibility and efficiency. Therefore, the results reveal the essential contribution of integrating decentralized finance applications, financial literacy, and regulatory technology to the development of Jordan's financial sector. Financial literacy serves as a facilitator, regulatory technology is a compliance enabler, and decentralized finance applications are driving forces of innovation and financial inclusion, ensuring a robust and sustainable financial ecosystem. It is shown that the interaction of factors forces the sector's development, reflecting the world's trend in digital inclusion and viable financial development.

Keywords fintech ecosystem, smart contracts, blockchain, Central Bank of Jordan (CBJ), financial sector development

JEL Classification G20, G28, O33

Received on: 1st of February, 2024
Accepted on: 22nd of April, 2024
Published on: 10th of May, 2024

Jamileh Ali Mustafa, Fintech Assistant Professor, Business Faculty, Financial and Accounting Sciences Department, Middle East University, Jordan.

Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

In the modern business environment, Fintech ecosystems are essential in determining the development paths of modern economies. An economy driven by a Fintech system develops and transforms at a frantic pace with a convergence of factors such as technological improvement, infrastructural capabilities, and market regulatory frameworks. Additionally, there is a critical attempt in the financial landscape, alongside the regulatory technology solutions that increase sector resilience through compliance, transaction monitoring, and real-time risk bridged by financial literacy. Thus, the integration of financial literacy, regulatory technology, and decentralized finance applications for financial development presents an essential scientific problem in the Fintech ecosystem. The scientific problem in question is complex due to the critical elements of technological advancement, regulatory compliance, and the expansion of regulatory services. This

integration process is fast and will impact the public's understanding of the technologies forcing the public to understand them for effective use. Financial literacy, therefore, will bridge the technology and the people to ensure effective use of the complex solutions that the people do not comprehend. Equal consideration will be given to concurrent compliance solutions, including the RegTech solutions that offer real-time compliance, risk management, and transaction monitoring, thus ensuring the depth of the financial sector. The critical elements above are vivid in Jordan, where the Central Bank of Jordan is committed to developing the critical sector of the economy. By working with tech companies and financial institutions, Fintech in Jordan experiences growth and development with decentralized finance and regulatory technology integration to benefit the industry.

1. LITERATURE REVIEW AND HYPOTHESES

The fast emergence of Fintech has driven transformative change in the financial industry, modifying the ways to access, receive, and regulate financial services (Alt & Puschmann, 2012; Asgari & Izawa, 2023). The review concerns the most influential factors that have contributed to this new environment development, which are Decentralized Finance applications (DeFi), Financial Literacy (FL), and Regulatory Technology (RegTech). It is important for the emergence of flexibility, inclusiveness, and resilience in the financial industry (Chiu, 2016). This paper analyzes the previous academic works on the above-mentioned three issues to place this study in the broader history of Fintech's impact on the development of the financial industry (Asgari & Izawa, 2023; Brown & Davis, 2019; Patel & Wang, 2023). Thus, DeFi defines that with the new services available through the decentralized technology of blockchain, decentralized finance opens various financial solutions unavailable for traditional banking structures. DeFi applications redefine financial relationships, enabled using smart contracts, oracles, and user interfaces. They heavily impact e-commerce, supply chain, real estate, and cryptocurrencies, contributing to the general broadening of financial solutions available and the financial industry growth. Its backbone is developed in blockchain, which in this way cuts down costs, improves transparency, and redevelops post-2008 trust in financial services (Allahham & Ahmad, 2024; Maurer, 2016; Natarajan & Gradstein, 2017). The paper supports the statements that DeFi is crucial for facilitating cost and trust in financial services and driving infrastructure innovation, as noted by Adisa et al. (2024), Bartoletti et al. (2020), Catalini and Gans (2016), and Gomber (2018).

In this changing environment, the interplay between Digital FL (DFL) and DeFi is essential. According to Prabhakaran and Mynavathi (2023), increased (DFL) is necessary to enable meaningful interaction with Fintech. Since improved FL promotes the effective use of DeFi, it is imperative to create specific educational initiatives to promote DFL as a means of developing an inclusive financial ecosystem (Arner, 2018; Ali Mustafa, 2023; Yue, 2022). Furthermore, established RegTech firms reconstructed DeFi platforms to help adjust to growing regulations, thereby creating a more secure financial environment (Anagnostopoulos, 2018; He et al., 2019; Kim et al., 2020). RegTech's impact transcends mere compliance because it also aids in eager literacy by offering clear measures on regulatory requirements and financial choices. Therefore, the interconnection between DeFi, RegTech, and FL entails a continuous cycle of specific improvement that is subsequent, where the growth of DeFi necessitates sophisticated RegTech schemes, and the two sectors combined work to advance FL to create a robust and lasting DeFi ecosystem (Smith et al., 2021; Johnson & Lee, 2022).

It is critical to note that understanding the importance of FL is necessary when assessing potential risks and their level of significance in countries' financial development (Van & Alessie, 2011; Vidovićová, 2022; Widyastuti, 2022). FL avails crucial financial resources for economic empowerment; hence, it also is essential to ensure the use of DeFi applications benefits its users effectively (Hasan et al., 2022; Prabhakaran & Mynavathi, 2023). The increased FL leads to more financial inclusion, making a vast and considerable contribution to financial sector development (FSD) (Basha & Goaied, 2023). The DeFi appli-

http://dx.doi.org/10.21511/imfi.21(2).2024.17

cation's acceptance and impactful utilization call for more FL. Wiradinata et al. (2023) noted that with sufficient patterns, higher FL is associated with low costs and risks regarding information acquisition needs. This implies that increased FL can aid the utilization of the previously discussed DeFi technologies. There is a cycle to it. The use of DeFi technology can support extra FL. Other studies note FL benefits with positive effects on Fintech. Widyastuti and Hermanto (2022) indicate how FL promotes easy access to microfinancing and advocacy in the design and integration of educational programs to enhance users' understanding. Another disruptive factor that has transformed the landscape of Fintech is Regtech (Becker & Buchkremer, 2020). This disruptive factor was created fermenting in the aftermath of the 2008 crisis; there has been a shift in academic focus toward how RegTech overlaps with Fintech innovations, enhancing societal benefits and public trust, with research yielding positive outcomes (Anagnostopoulos, 2018; Brem et al., 2017). Central banks, as noted by Gomber et al. (2017), Katona (2021), and Zhu and Zhou (2016), have focused on the evolving interplay of Fintech regulations, adapting to innovative technologies that redefine conventional norms. Other scholars have also focused on different aspects. For example, Arner et al. (2016) and Momtaz (2022) have conducted a similar field-specific analysis based on Regtech for Financial Stability, AML, and Cyber Risk. Regtech incorporates the utilization of information technology to help monetary entities harness internal governance and achieve regulatory sanctions from the regulator (Anagnostopoulos, 2018). This internal operation is enhanced through an alignment of systems, an analysis of systems, mining of records, and several other systems known as financial analytics, which help firms undertake compliance effectively with a lot of accuracy.

Regtech is critical not just because it drives broad compliance but also because it underpins the stability of the Fintech ecosystem. Anagnostopoulos (2018) and Berm et al. (2017) refer to the critical role of Regtech in strengthening the financial system's integrity and resilience, which corresponds with Battiston et al. (2016) that stringent regulation and risk management are inevitable for the FSD. This paper concludes that appropriate regulatory systems must be established before the great fall. Other scholars also focused on the potential benefits of regulating DeFi by creating transparent, effective contracts and accountability with efficient transactions.

However, at the same time, their mutual reinforcement creates synergy, catalyzing major compliance and innovation in the financial sector. Moreover, enhanced FL does not just increase individuals' knowledge of financial products and regulatory frameworks to improve compliance, but it also prepares them to be more efficient and competent consumers of Regtech solutions (Mrope et al., 2017; Smith et al., 2021). This, in turn, gives Tribes enhanced financial knowledge; hence, Regtech innovations contribute relatively to FL by clarifying complicated regulatory matters and facilitating individual understanding (Johnson & Lee, 2022). This bidirectional facilitation creates a feedback loop (Finkelstein et al., 2019), where stronger FL leads to increased adoption and innovation in Regtech and vice versa, as in White and Zhao (2023), which further simplifies financial regulations for individual consumers, leading to more informed decision-making and expertise in FL. Patel et al. (2024) further support this model for a more informed population, indicating that a population that is more financially literate is more capable of engaging with and benefiting from the innovative new Regtech technologies, enhancing each other cyclically.

These scholars highlight the need for a flexible regulatory approach that keeps pace with the swift advancements in financial technology. By integrating these perspectives, the perception of Regtech's integral role in the contemporary financial ecosystem is enriched, particularly regarding DeFi's growth and the key aim to achieve a stable and trustworthy financial sector.

In conclusion, while existing literature has individually explored FL, RegTech, and DeFi, the interaction impact of these elements on FSD remains underexplored. Yet, a holistic analysis of how FL, RegTech, and DeFi collectively influence the financial sector, particularly in a developing country context like Jordan, is lacking. This study seeks to fill this gap by investigating

the integrated roles of FL, Regtech, and DeFi in the evolution of Jordan's financial ecosystem, positing a dynamic, interdependent relationship among these elements that collectively drive and enhance FSD. This led to research hypotheses as follows:

H1: *DeFi applications enhance FL, as well as the effectiveness of supervision and regulatory frameworks.*

H2: *RegTech facilitates the advancement of FL level, thereby promoting the adoption of DeFi applications.*

H3: *FL is crucial for augmented engagement with DeFi applications governed by RegTech.*

H4: *The progression of the FinTech ecosystem's impact on FSD depends on the collaborative integration of RegTech, FL, and DeFi applications.*

2. METHOD

EViews 10 was subjected to a two-step analytical approach within this study for two reasons. Firstly, each factor of FL, RegTech, and DeFi applications was tested separately to check the effect of the mentioned factors on FSD individually, and then their integration influence to check if it enhances FSD more than when each of them affects separately. Therefore, the dependent variable (DV), the FSD index, is calculated as total assets in financial institutions in % of GDP to estimate financial development in Jordan. This index links the three primary indicators currently used by the World Bank Global Financial Development Database and utilized by diverse researchers based on these data (Asteriou & Spanos, 2019; Li et al., 2019; Liu, 2003; Lavrinenko et al., 2023). Based on a union data set, each of their roles is analyzed separately. Researchers differ from others in the demographic entity that utilizes the same variables (Anagnostopoulos, 2018; Abdullah Ismail Al-Qaruty et al., 2023; Samia et al., 2023; Cai et al., 2022). Additionally, the annual inflation rate shown by an annual CPI was controlled in the study because it is an FSD threshold (Becha, 2023). The study metrics are provided in Table 1.

Therefore, the proposed regression model is as follows:

$$FSD_{it} = \beta_1 EW_{it} + \beta_2 EFW_{it} + \beta_3 EMT_{it} + \beta_4 POS_{it} + \beta_5 MOB_{it} + \beta_6 DUM_t + \beta_7 ACH_{it} + \beta_8 CPI_t + \varepsilon_{it}. \quad (1)$$

Firstly, the one-factor regression analysis for each variable is conducted by using the secondary data of 2,880 observations from 23 financial institutions in Jordan during the period 2011 to 2022, after accompanying the essential primary tests on research data, containing the stationarity, panel co-integration, and the cross-sectional dependence tests; the co-integration regression is built by using fully modified OLS used by Phillips and Hansen (1990) to run ideal estimations of co-integrating regressions model for this study and examine the role of the integration between the three factors in improving the financial ecosystem development. The significance of the judge variables in the model was decided by relating their probability values to $\alpha = 0.05$. A judge variable was deemed significant if its probability value was less than α.

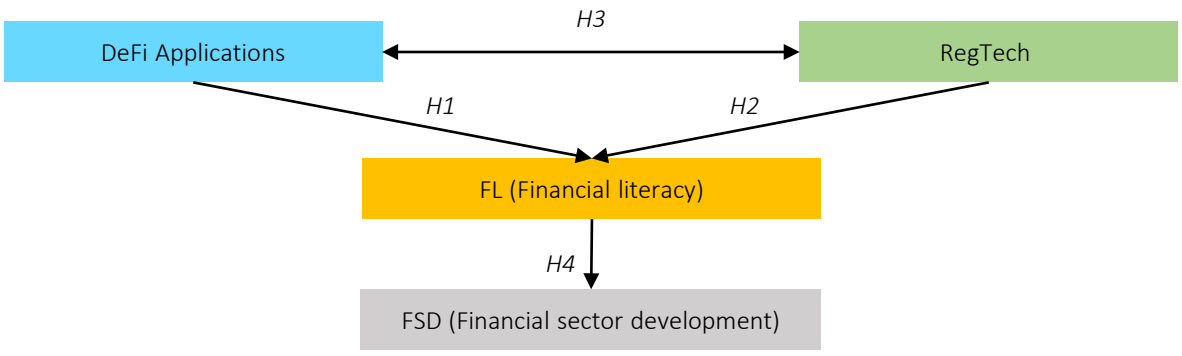


Figure 1. Visual representation of study hypotheses

http://dx.doi.org/10.21511/imfi.21(2).2024.17

Table 1. Research metrics

Variables	Gauge	Data Source
Dependent Variable		
FSD (Financial Sector Development Index)	Total financial assets to GDP: Total assets of the financial system in Jordan relative to annual GDP	CBJ Financial Stability Report 2012–2021; World Bank; IMF
Independent Variables		
1.DeFi Applications		
EW (Electronic Wallet Accounts)	Number of electronic wallet accounts in 8 companies & 18 banks certified by CBJ	CBJ Annual Report on National Payment System; Jomopay; Madfooatkom reports
EFW (e-FAWATER.com Transactions)	Total e-FAWATER.com bill collections and other payments, both financial and non-financial	CBJ Annual Report on National Payment System; Jomopay; Madfooatkom reports
EMT (Electronic Money Transfers)	Financial transactions are executed through electronic payment systems for money transfers	CBJ Annual Report on National Payment System; Jomopay; Madfooatkom reports
2. Financial Literacy		
POS (Card Transactions)	Payment orders are executed through systems for card transactions via POS and ATM	CBJ Annual Report on National Payment System; Banks; Jomopay; Madfooatkom reports
MOB (Internet & Mobile Banking Users)	A number of Internet and mobile banking users.	CBJ Annual Report on National Payment System; Banks; Jomopay; Madfooatkom reports
3. Regulation and Supervision		
DUM (Regulatory Dummy)	Dummy variable: 0 before 2017, 1 thereafter, indicating regulatory changes	CBJ Annual Reports 2011–2022
Infrastructure: ACH (Automated Clearing House Transactions)	Payment orders are executed through the ACH system	CBJ Annual Report on National Payment System; Banks; Jomopay; Madfooatkom reports
4. CPI (Inflation Rate)	Annual change in consumer prices	World Bank Open Data

3. RESULTS

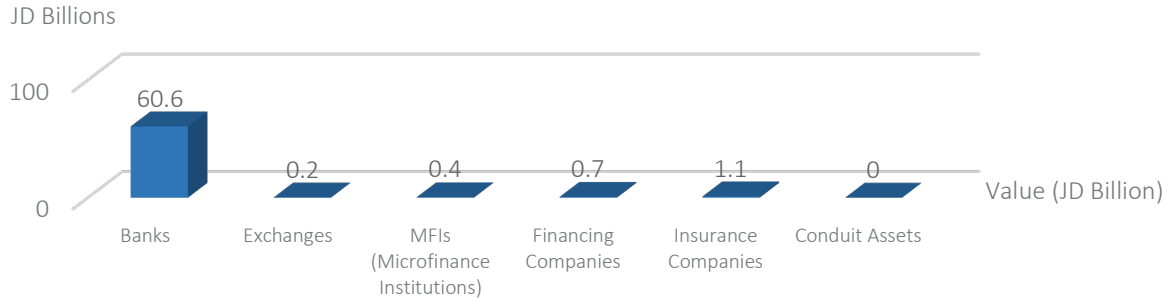
This study started with an overview of the elaboration levels within Jordan's financial system compared to those of countries across various income levels in Table 2, based on average data from 2010 to 2021. This comparative analysis seeks to shed light on Jordanian's financial sector development relative to global financial trends and developments.

Jordan is classified as an upper middle-income class according to the World Bank. The contribution of the financial sector assets reaches 8.0% % of GDP, which indicates a significant presence of deposits within the financial sector. However, the insurance industry assets contribute to GDP (3.34%) and stock market capitalization GDP (69.32%) is relatively lower compared to some other high-income countries. The after-tax return on assets of Jordanian banks is 1.02% compared to other UMI countries. Regarding relatively high income, Jordan's financial ratios, such as stock market capitalization to GDP are lower. On the other hand, Jordan outperforms some countries with similar income levels, such as China and Turkey, in certain indicators, including financial sector deposits to GDP.

The financial sector in Jordan is regulated by the Central Bank of Jordan (CBJ); it involves banks, exchange companies, insurance, financing, and lending-based crowdfunding. Figure 2 shows that banks dominate the financial sector in Jordan, formulating around 60.6 billion total assets. Also, Jordan enjoys a sound and solid banking system that can withstand the shocks and high risks due to the high and satisfactory levels of capital that are the highest in the Middle East and North Africa (MENA) region, in addition to the comfortable levels of liquidity and profitability (JFSR,2021).

3.1. Descriptive statistics

Table 3 shows the average FDI is slightly below the median at 1.93% and 1.94%, respectively, indicating a distribution that is roughly symmetrical to give a detailed insight into Fintech factors including EWD, EFW, EMT, POS, MOB, and ACH.



Note: CBJ annual stability report 2022.

Figure 2. Financial sector composition in Jordan (2022)

Table 2. Financial development measures

Source: World Bank Findex data, 2022.

Country	Income level	Region	Financial sector deposits to GDP, %	Insurance industry assets to GDP, %	Stock market capitalization to GDP, %	Banks' after-tax return on assets, %
UAE	High	Middle East	78.81	5.30	51.46	1.56
Bahrain	High	Middle East	73.81	15.69	64.82	1.19
Qatar	High	Middle East	78.18	4.35	91.58	1.87
Saudi Arabia	High	Middle East	33.00	1.89	109.07	1.83
US	High	North America	83.24	51.49	143.03	1.03
Germany	High	Europe	83.64	61.57	48.33	–0.0007
China	UMI	East Asia	50.70	17.23	59.23	0.99
Jordan	UMI	Middle East	95.19	3.34	69.32	1.02
Brazil	UMI	Latin America	60.69	12.28	48.87	1.15
Turkey	UMI	Europe	51.27	4.13	26.06	1.41
Egypt	LMI	Middle East	69.19	2.49	19.45	1.38
Algeria	LMI	Middle East	47.53	1.31	0.13	1.33
Sri Lanka	LMI	South Asia	42.08	6.68	25.14	1.37

Note: UMI: Upper Middle Income, LMI: Lower Middle Income.

In the case of EWD, the number of electronic wallets, the average value is substantial, is 653,084.86, but this is reduced to a median of 450,394.00 pointing towards a distribution that is skewed to the right. This skewness is further accentuated by the mode of 51,823.00 and a wide-ranging spread from 51,823.00 to 2,050, 000.00. EFW, the number of bills electronically paid by using the e-FWATER.com application, demonstrates a significant difference between its mean of 15,761,714.33 and median of 13,650,105.00. Regarding EMT and electronic money transfer, the mean and median are 367,366.57 and 346,653.00, respectively, with a mode significantly low at 120,395.00. The values range between 120,395.00 and 635,049.00, indicating a moderate spread. Further, POS, the number of payments through the point-of-sale machine,

Table 3. Summary statistics

Factor	Mean	Median	Mode	Maximum	Minimum
FDI%	1.93	1.94	1.78	2.07	1.78
EW	653084.86	450394.00	51823.00	2050000.00	51823.00
EFW	15761714	13650105	478218.00	34162672.0	478218.00
EMT	367366.57	346653.00	120395.0	635049.00	120395.0
POS	41147924	19057783	2766960	81000000	2766960
MOB	1232268.3	976412.00	496886.0	2800000.0	496886.0
ACH	3841425.0	2569633.0	120395.0	9646151.0	120395.0
CPI%	2.08	2.12	–0.88	4.82	–0.88

http://dx.doi.org/10.21511/imfi.21(2).2024.17

shows a mean of 41,147,924.40, which is notably higher than the median of 19,057,783.00, indicating a distribution with significant right skewness. On the other hand, for MOB, the number of users of internet and mobile banking, the average is 1,232,268.29, with a median of 976,412.00 and a mode of 496,886.00. The broad spread from 496,886.00 to 2,800,000.00 reveals diverse market conditions. Finally, the number of payment orders executed through the automated clearing house (ACH) system reached an average of 3,841,425.00 and a median of 2,569,633.00, but a much lower mode of 120,395.00. The range is substantial, with a maximum value of 9,646,151.00 and a minimum of 120,395.00, which suggests a significant variation in digital infrastructure.

For further analysis, the study plots the trend of financial sector development (FDI) with each variable throughout the study in Figure 3. The trend of FDI shows a general increase over the years, starting with a value above 1.7 in 2011 and experiencing steady growth until 2014, and remained relatively stable with minor fluctuations through 2016 and then rose in 2018. However, in 2021, FDI fell back to a level below that of the starting year due to the COVID-19 pandemic.

The trends of the other variables also show varied patterns over the years. For example, electronic wallets (EW) and e-Fawateer.com payment systems (EFW) have shown a particularly steep rise since they were applied in 2014, and EMT exhibited a gradual increase.

POS showed a continuous increase due to the gradual demand for this sector. Mobile subscriptions started to be used in Jordan in 2015 suggesting an expansion in this area, with the trend sharply increasing gradually. Finally, ACH started effectively working in 2016, followed by a sharp escalation, indicating significant developments or milestones being reached in the latter half of the decade.

For Regtech changes across the study period, Table 4 exhibited the most significant changes in laws issued by CBJ to organize the Fintech sector.

3.2. Regression analysis results

Under one-factor analysis, EFWit showed a significant positive effect with a coefficient = 0.017, p = 0.03, while POSit reported a further positive influence with a coefficient = 1.257, p = .001. Both DUMit and ACHit were statistically significant with minor coefficients (0.004 and 0.001, respectively). Surprisingly,

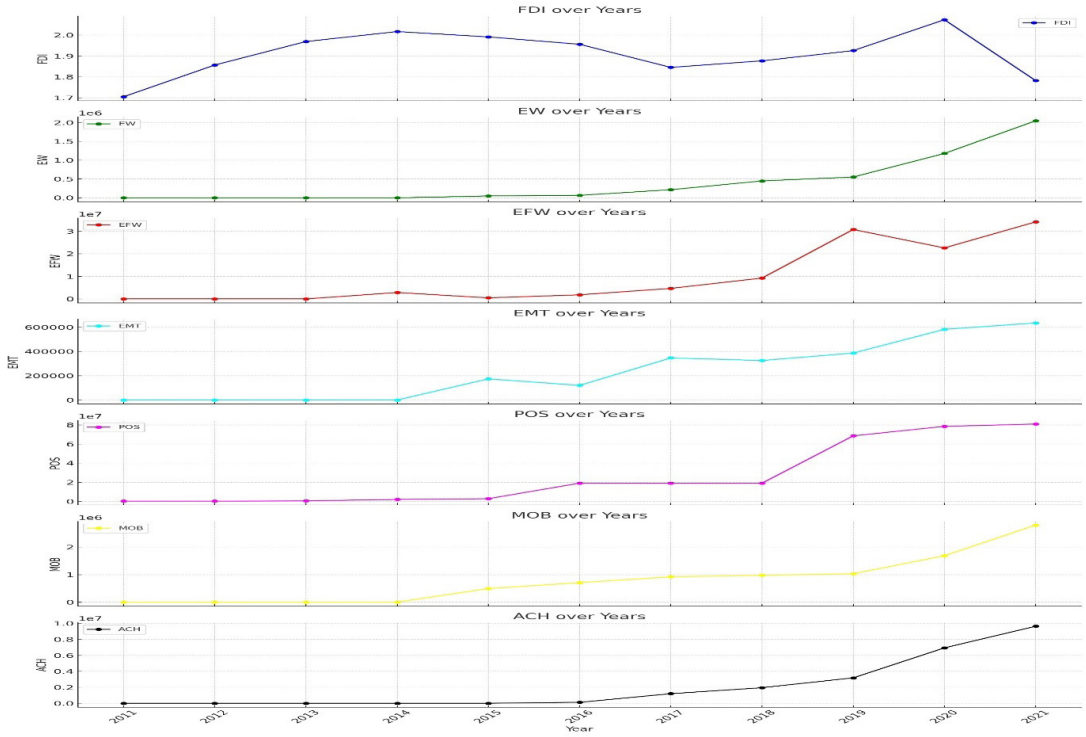


Figure 3. Research variables trend

Table 4. CBJ regulatory instructions (2011–2022)

Source: CBJ Annual Report on National Payment System, 2022.

Year	Regulatory Instruction
2011	Establishment of Madfooatkum for Electronic Payment.
2017	Issuance of Electronic Money Transfer and Payment System Regulation No. 111.
2019	Madfooatkum for Electronic Payment was licensed by the Central Bank on 04/02/2019 under Regulation No. 111 of 2017.
2020	On 15/10/2020, the company was licensed as a payment service provider through the JoMoPay mobile payment system.
2020	Instructions for accrediting global payment systems, requiring international entities to comply with these provisions.
2021	Modified instructions for 'Regulating Know Your Customer (KYC) Procedures Electronically'.
2021	By the end of the year, 15 companies were licensed for electronic payment and money transfer activities.
2022	Instructions for the organization of open financial services operations affecting all banks and licensed payment and money transfer companies in the kingdom.
2022	No new electronic money transfer and payment licenses were issued; 7 companies were licensed as operators of electronic payment systems for financial transactions. The company was licensed to practice electronic funds collection services through merchants' points of sale.

CPIt showed a substantial negative relationship (coefficient = –2.714, p = 0.001). However, EWit, EMTit, and MOBit have not reached conventional levels of statistical significance.

Before conducting FMOLS regression, unit root tests (such as Levin, Lin & Chu, and Im, Pesaran, and Shin W-stat) and cointegration tests (Kao and Pedroni) were performed to ensure the appropriateness of this approach for study panel data. The FMOLS analysis, addressing potential non-stationarity and endogeneity concerns, yielded inconsistent results where EFWit, POSit, DUMit, and ACHit remained significant, though CPIt's significance level changed, indicating a complex, context-dependent relationship.

The FMOLS model's R-squared and adjusted R-squared values are 34% and 28.2%, respectively, which indicate moderate explanatory power due to the use of secondary data in social sciences and economic-related disciplines. Additionally, significant p-values are associated with the study variables designated, indicating that, despite the lower R2, the model captures relevant relationships within the data.

Table 5. One-factor regression analysis results

Variable	Coefficient	Standard Error	t-Statistic	P-value
EFW_{it}	0.017	0.003	5.7	0.03
POS_{it}	1.257	0.15	8.38	.001
DUM_{it}	0.004	0.001	4.01	0.01
ACH_{it}	0.001	0.0005	2.02	.03
CPI_{it}	–2.714	0.25	–10.86	0.001
EW_{it}	0.05	0.03	1.7	.07
EMT_{it}	.04	.33	.12	.09
MOB_{it}	0.005	0.007	.7	0.082

Table 6. FMOLS cointegration regression analysis

Variable	Coefficient	Standard Error	t-Statistic	P-value
EFW_{it}	0.009	0.004	2.25	.003
POS_{it}	1.1	0.2	5.5	.041
DUM_{it}	0.003	0.002	1.5	.01
ACH_{it}	0.0008	0.0002	4.0	.03
CPI_{it}	–2.5	0.3	–8.33	.042
EW_{it}	0.01	0.1	0.1	.06
EMT_{it}	.032	0.3	1.06	.2
MOB_{it}	0.0035	0.002	1.75	.07
R^2		34%		
Adj R^2		28.2%		

http://dx.doi.org/10.21511/imfi.21(2).2024.17

It is worth noting that regression results are consistent with the study's hypotheses and emphasize the need for adaptive strategy in the financial sector, integrating technological solutions, regulatory foresight, financial awareness, and macroeconomic stability to foster the development of the financial ecosystem. Supported by FMOLS analysis, which showed some variations in coefficient values compared to the one-factor regression, demonstrating the importance of considering integration among Fintech ecosystem factors. For occasion, in the FMOLS regression, the coefficient for EFWit decreased to 0.009 from 0.017 in the one-factor analysis, while POSit showed a slight reduction to 1.1 from 1.257. These differences indicate a shift in the magnitude of their impacts in a long-term, integrated context. Similarly, coefficients for DUMit and ACHit also exhibited reductions (0.003 and 0.0008, respectively), further reinforcing this trend.

4. DISCUSSION

In practice, this study is aligned with significant research contributions and provides unique insights about the integration between Fintech factors within Jordan's emerging financial landscape. The regression analysis conducted aligns with the proposed hypotheses, demonstrating a dynamic interconnection among the Fintech critical factors to achieve sustainable FSD. It also incorporates the effects of both significant and non-significant Fintech factors along with the influence of inflation, which offers a comprehensive view of the dynamics shaping Fintech development. The results revealed a negative impact of inflation rate on FSD, aligning with previous research (Johnson & Ali, 2022; Gupta & Martínez, 2022; O'Connor & Singh, 2024), which reported the negative effects of inflation on the growth of total assets and profitability of financial institutions.

The regulations of Fintech services effectively commenced at the beginning of 2015 by issuing Electronic Transactions Law No. 15 to regulate E-payment services. The CBJ's initiatives facilitate electronic external transfers through platforms such as e-FAWATEER.com, enhancing the efficiency and accessibility of digital financial services for users, and collaborations with banks and e-wallet companies to expand digital services. Furthermore, the CBJ Sand Boxes functions as a regulatory environment for Fintech innovation allowing entrepreneurs to test their Fintech innovations in a real-world setting, ensuring both innovation and regulatory compliance. This is crucial for fostering a culture of innovation within the financial sector.

According to the dummy variable (Dum), which reflects on post-2017 regulatory changes, findings resonate with Arner et al. (2017) and Buckley et al. (2020) who highlight the significance of regulation in fintech. Additional studies include Barberis et al. (2016) and Chiu (2017) and emphasize Regtech's role in enhancing financial regulation's adaptability and efficiency.

Prior research (Williams, 2018; Klein, & Glied 2019; Gonzalez & Murphy, 2022, Goldberg & Knill, 2020) explored how efficient payment systems, particularly ACH, contribute to FSD by supporting Fintech adoption. Further, they investigated the role of digital payment systems, the unconfined impact of digital payment infrastructure on the financial sector, and a comprehensive investigation into the profound influence that digital payment infrastructures, including ACH systems, exert on the broader financial sector and the rapidly evolving fintech landscape. These studies support the current study of the significant effect of ICT infrastructure on Fintech ecosystem development.

Also, Jordan's digital payments infrastructure plays a critical role in improving the use of DeFi applications. The results indicate high levels of interconnectivity and interoperability among e-payment agents and varied payment ecosystems such as ATMs, card acquirers, and e-payment platforms. The Key gears of its payment infrastructure include the automated clearing house (ACH) for interbank transfers, the real-time gross settlement system (RTGS), the electronic cheque clearing system (ECC), JoNet for bank-to-ATM transactions, and JoMoPay for mobile payments together with the MEPS and EMPS shifts for retail payments. These systems facilitate digital and mobile payment methods, though their utilization rates are relatively low. Afterwards, Jo-PACC is managed by the national mobile payments switch, JoMoPay, enhancing interoperability among all mobile payment service providers. This connection allows

end users, through mobile devices, to access the country's payment ecosystem, thereby promoting financial inclusion for a broad user base, including underserved populations and refugees.

Regarding the financial literacy demonstrated through POS, as well as the adoption of internet and mobile banking (Mob), this showed positive impacts on financial development with relatively low coefficients indicating challenges in broader financial inclusion in Jordan. The findings are supported by the scholarly contributions of Mitchell (2014), Kumar et al. (2019), and Zhou and Abrams (2023), who collectively affirm the beneficial effects of financial literacy. Complementary investigations (Xiao et al., 2014; Allgood & Walstad, 2016) further substantiate the critical role of financial literacy in enhancing financial decision-making and overall financial well-being. The low coefficients imply an apportion of un-banked and under-banked units besides anxiety about the risks coupled with emerging Fintech instruments. As a result, the CBJ and the Ministry of Education have contained FL in schools and advocated entrepreneurship, intending to increase financial awareness, directing basic financial perceptions, including savings, investment choices, and leveraging financial services for sustainable development.

Even though the literacy level in Jordan has been rising significantly in recent years, it still lags, specifically among financially excluded units, which are often more opposed to technological switch. The need for enhanced digital financial literacy is evident.

In terms of DeFi applications, the analysis showed that the e-FAWATEER.com application had a significant effect on FSD, despite the insignificant effect of Electronic Wallet Transactions and Electronic Money Transfers in the study. It is supported by Shaikh and Karjaluoto (2015) and Ozili (2018), who showed that the impact of such digital financial services might be nuanced and influenced by consumer trust, adoption rates, and economic conditions. It is worth noting that since 2014, Jordan's financial sector has witnessed significant disruption in its financial products and services with the adoption of DeFi applications. This marked an evolution towards progressed digital financial systems, including the use of ACH and e-FAWATEER.com applications. The transition also immersed an increased trust in several payment cards within POS, demonstrating an extensive move towards decentralization in financial transactions. Consequently, the CBJ responded by proposing a new law No. (111) of 2017 aimed to regulate all Fintech service providers operating in Jordan and to address the prospective risks associated with Fintech services that could enhance financial literacy by slashing the complexities of DeFi through compliance requirements and progress individuals to adopt Fintech solutions.

Although Jordan preserves the use of cryptocurrencies, the improvement of DeFi in Jordan is also dependent on the country's ICT infrastructure efficiency, the degree of Fintech literacy, and proficiency in Defi technology. DeFi applications were not extensively compromised in Jordan, but the global direction towards it indicates potential for progress, conditional on regulatory advancement and users' acceptance.

It appears that CBJ deems the necessity of synchronization with rapid developments in Fintech to serve the banking and financial sector in a manner that confirms resiliency, safety, and stability. For this purpose, CBJ expresses its continuous support for entrepreneurship in the Fintech sector especially in (2020) after facing a significant downturn in the financial sector due to the COVID-19 pandemic, with a notable increase in the use of DeFi applications. This spillover in DeFi usage can be attributed to its digital and contactless financial solutions spurred by the pandemic's restrictions on physical interactions, simultaneously enhancing financial literacy among users. Furthermore, individuals and businesses turned to DeFi platforms new challenges and opportunities are posed for regulatory bodies in Jordan, for instance, in 2022 CBJ issued instructions to regulate open banking services and mandated all banks and electronic financial services providers licensed to operate in Jordan are required to open Account Information and Payment Initiation services to authorized third-party providers by the end of 2023.

In 2023, Jordan witnessed the initial stages of DeFi applications, with indicators pointing towards potential expansion in the future. DeFi, which utilizes blockchain technology, lacks the

http://dx.doi.org/10.21511/imfi.21(2).2024.17

need for central intermediaries and is significantly influenced by the regulatory framework established by CBJ. Research analysis of DeFi applications reveals a significant effect of e-FAWATER.com transactions and an insignificant impact of electronic wallet accounts and electronic money transfers on DFS. These results indicate the intricacy of the Fintech ecosystem is influenced by factors such as consumer awareness and economic conditions.

CONCLUSION

The objective of this study is to investigate the influence of FL, RegTech, and DeFi applications, thus the importance of their synergistic effect on the progress of the financial ecosystem in Jordan. The results indicate that combining DeFi applications, financial literacy, and RegTech leads to a sustainable recovery in the context of the financial industry's development. Moreover, financial literacy delivers a critical level of knowledge to the customers and enterprises to navigate the ever-complicated Fintech landscape better. This is crucial because DeFi applications work based on blockchain with smart contracts. This technology concept offers banking services on a verified, sequenced, and authoritative level. RegTech in its turn, plays the role of a regulator in the system as it ensures that the advanced aspects of DeFi work within enforced compliance and awareness of the regulation's needs. Thus, it reduces risks and increases trust and stability in the field.

To effectively guide the assimilation of DeFi applications, Regtech, and financial literacy in Jordan, a comprehensive approach is recommended. First, reinforce the regulatory frameworks for DeFi to provide obvious rules that foster innovation and continuation counter to risks. Second, a need for a mixture of comprehensive financial education programs along with binding partnerships with educational entities, Fintech service providers, and regulatory bodies. Third, implementing cybersecurity requirements treating the three factors as one hand might help in bridging gaps between Fintech stakeholders, regulatory groups, and traditional financial companies.

This study strongly recommends using smart contracts within financial institutions in Jordan to revolutionize service offerings, specifically in insurance companies. Additionally, it encourages the adoption and regulatory support of cryptocurrencies issued by central banks, which could pave the way for more inclusive, and secure financial transactions. The formation of a regulatory sandbox is also necessary, permitting the trial testing of innovative DeFi products and services in a controlled environment.

Finally, the integration of these three elements fosters a more inclusive and efficient financial ecosystem by leveraging pioneering Fintech solutions and protecting ecosystem participation. It also improves financial inclusion and the democratization of financial services, contributing significantly to the overall sustainable development of the financial sector.

AUTHOR CONTRIBUTIONS

Conceptualization: Jamileh Ali Mustafa.
Data curation: Jamileh Ali Mustafa.
Formal analysis: Jamileh Ali Mustafa.
Funding acquisition: Jamileh Ali Mustafa.
Investigation: Jamileh Ali Mustafa.
Methodology: Jamileh Ali Mustafa.
Project administration: Jamileh Ali Mustafa.
Resources: Jamileh Ali Mustafa.
Software: Jamileh Ali Mustafa.

Supervision: Jamileh Ali Mustafa.
Validation: Jamileh Ali Mustafa.
Visualization: Jamileh Ali Mustafa.
Writing – original draft: Jamileh Ali Mustafa.
Writing – review & editing: Jamileh Ali Mustafa.

REFERENCES

1. Abdollah, K. A. B. (2022). *The Impact of Financial Literacy on the Adoption of Fintech and Defi Applications* (Doctoral dissertation, Master Thesis). Kuala Lumpur: Universiti Tun Abdul Razak.
2. Alam, T. (2019). *Blockchain and its Role in the Internet of Things (IoT).* https://doi.org/10.31219/osf.io/cmza5
3. Allahham, M., & Ahmad, A. (2024). AI-induced anxiety in the assessment of factors influencing the adoption of mobile payment services in supply chain firms: A mental accounting perspective. *International Journal of Data and Network Science, 8*(1), 505-514. http://dx.doi.org/10.5267/j.ijdns.2023.9.006
4. Al-Qaruty, T. M. R., Areiqat, A. Y., & Jaradat, N. M. (2023). Synergy between FinTech, RegTech, and Artificial Intelligence in Transforming the Financial Ecosystem. *Onomázein*, *61*(September), 757-763. Retrieved from http://www.onomazein.com/index.php/onom/article/view/186
5. Alshubiri, F. (2021). The stock market capitalization and financial growth nexus: an empirical study of western European countries. *Future Business Journal, 7,* 46. https://doi.org/10.1186/s43093-021-00092-7
6. Alt, R., & Puschmann, T. (2012). The rise of customer-oriented banking-electronic markets is paving the way for change in the financial industry. *Electronic Markets, 22,* 203-215. http://dx.doi.org/10.1007/s12525-012-0106-2
7. Amponsah, A. A., Adebayo, F. A., & WEYORI, B. A. (2021). Blockchain in insurance: Exploratory analysis of prospects and threats. *International Journal of Advanced Computer Science and Applications, 12*(1). http://dx.doi.org/10.14569/IJACSA.2021.0120153
8. Anagnostopoulos, I. (2018). Fintech and regtech: Impact on regulators and banks. *Journal of Economics and Business, 100,* 7-25. https://doi.org/10.1016/j.jeconbus.2018.07.003
9. Anagnostopoulos, I. (2018). Fintech and regtech: Impact on regulators and banks. *Journal of Economics and Business, 100,* 7-25. https://doi.org/10.1016/j.jeconbus.2018.07.003
10. Arner, D. W., Barberis, J., & Buckey, R. P. (2016). FinTech, RegTech, and the reconceptualization of financial regulation. *Northwestern Journal of International Law & Business, 37,* 371. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2847806
11. Asgari, B., & Izawa, H. (2023). Does FinTech penetration drive financial development? Evidence from panel analysis of emerging and developing economies. *Borsa Istanbul Review, 23*(5). https://doi.org/10.1016/j.bir.2023.06.001
12. Becha, H., Kalai, M., & Helali, K. (2023). *Smooth transition regression model relating inflation to economic growth in Tunisia.* http://dx.doi.org/10.1186/s40008-023-00308-9
13. Becker, M., Merz, K., & Buchkremer, R. (2020). RegTech – the application of modern information technology in regulatory affairs: areas of interest in research and practice. *Intelligent Systems in Accounting, Finance, and Management, 27*(4), 161-167. https://doi.org/10.1002/isaf.1479
14. Blockchain.com. (n.d.). *Blockchain Charts.* Retrieved from https://www.blockchain.com/charts/
15. Bose, S., Dong, G., Simpson, A., Bose, S., Dong, G., & Simpson, A. (2019). The role of finance in achieving sustainability. *The Financial Ecosystem: The Role of Finance in Achieving Sustainability,* 1-18. http://dx.doi.org/10.1007/978-3-030-05624-7_1
16. Cai, C., Marrone, M., & Linnenluecke, M. (2022). Trends in Fintech research and practice: Examining the intersection with the information systems field. *Communications of the Association for Information Systems, 50*(1), 40. Retrieved from https://aisel.aisnet.org/cais/vol50/iss1/40/
17. Casino, F., Dasaklis, T. K., & Patsakis , C. (2019). A systematic literature review of blockchain-based applications: Current status, classification, and open issues. *Telematics and Informatics, 36,* 55-81. https://doi.org/10.1016/j.tele.2018.11.006
18. Central Bank of Jordan. (2012–2022). *Financial stability report.* Retrieved from https://www.cbj.gov.jo
19. Central Bank of Jordan. (2016–2022). *Annual report on the national payment system.* Retrieved from https://www.cbj.gov.jo
20. Chao, X., Ran, Q., Chen, J., Li, T., Qian, Q., & Ergu, D. (2022). Regulatory technology (Reg-Tech) in financial stability supervision: Taxonomy, key methods, applications, and future directions. *International Review of Financial Analysis, 80,* 102023. https://doi.org/10.1016/j.irfa.2022.102023
21. Chiu, I. H. (2016). Fintech and disruptive business models in financial products, intermediation and markets-policy implications for financial regulators. *Journal of Technology Law & Policy, 21*, 55. Retrieved from https://discovery.ucl.ac.uk/id/eprint/1528728/1/The%20Disruptive%20Implications%20of%20FinTech%20Rev.pdf

http://dx.doi.org/10.21511/imfi.21(2).2024.17

22. Dai H. N., Z. Zheng, Y. Zhang, (2019). Blockchain for the Internet of Things: A Survey. *IEEE Internet Things Journal.* Retrieved from https://ieeexplore.ieee.org/document/8731639

23. Daoud, M. K., Taha, S., Al-Qeed, M., Alsafadi, Y., Bani Ahmad, A. Y., & Allahham, M. (2024). *EcoConnect: Guiding environmental awareness via digital marketing approaches.* Retrieved from https://www.growingscience.com/ijds/Vol8/ijdns_2023_176.pdf

24. Dara, S. R., & Mariah, M. (2020). Peran Fintech Dalam Upaya Untuk Meningkatkan Literasi Keuangan Pada Masyarakat di Jakarta. *AKURASI: Jurnal Riset Akuntansi Dan Keuangan, 2*(3), 127-138. https://doi.org/10.36407/akurasi.v2i3.240

25. Dorri, A., Kanhere, S. S., & Jurdak, R. (2016). *Blockchain in the internet of things: challenges and solutions*. https://doi.org/10.48550/arXiv.1608.05187

26. Dudka, L. (2022). Assessing and Improving the Financial Literacy of the Population. *Economic and Social Development: Book of Proceedings,* 214-220. Retrieved from https://www.proquest.com/openview/86620923b912e083e506a3605b123581/1?pq-origsite=gscholar&cbl=2033472

27. Gohil , D., & Thakker, S. V. (2021). Blockchain-integrated technologies for solving supply chain challenges. *Modern Supply Chain Research and Applications, 3*(2), 78-97. https://doi.org/10.1108/MSCRA-10-2020-0028

28. Haddad, H., Al-Bawab, A. A., & Marei, A. (2023). The impact of the COVID-19 pandemic on the auditing profession. *International Journal of Professional Business Review, 8*(5), e01689. https://doi.org/10.55908/sdgs.v11i10.1783

29. Haddad, H., Al-Qudah, L. U. M. A., Almansour, B. Y., & Rumman, N. A. (2022). Bank Specific and Macroeconomic Determinants of Commercial Bank Profitability: in Jordan from 2009-2019. *ELIT–Economic Laboratory for Transition Research Dz. Washingtona 4/5,* 18(4), 155-166. https://doi.org/10.14254/1800-5845/2022.18-4.13

30. Hasan, M., Noor, T., Gao, J. (2022). Rural Consumers' Financial Literacy and Access to FinTech Services. *Journal of the Knowledge Economy*. https://doi.org/10.1007/s13132-022-00936-9

31. Javaid, M., Haleem, A., Singh, R. P., Suman, R., & Khan, S. (2022). A review of Blockchain Technology applications for financial services. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations,* 100073. https://doi.org/10.1016/j.tbench.2022.100073

32. Jopaac. (2019-2022). *Annual report.* Retrieved from https://www.jopacc.com/information-center/publications

33. Katona, T. (2021). Decentralized finance: The possibilities of a blockchain "money lego" system. *Financial and Economic Review, 20*(1), 74-102. Retrieved from https://ideas.repec.org/a/mnb/finrev/v20y2021i1p74-102.html

34. Koroleva, E. (2022). FinTech Entrepreneurial Ecosystems: Exploring the Interplay between Input and Output. *International Journal of Financial Studies, 10*(4), 92. https://doi.org/10.3390/ijfs10040092

35. Kumar, A., & Garcia, M. (2024). Blockchain in Cross-Border Transactions: An Empirical Analysis. *International Journal of Blockchain Economics, 7*(1), 65-83. http://dx.doi.org/10.2139/ssrn.4550837

36. Lavrinenko, O., Čižo, E., Ignatjeva, S., Danileviča, A., & Krukowski, K. (2023). Financial Technology (FinTech) as a Financial Development Factor in the EU Countries. *Economies, 11*(2), 45. https://doi.org/10.3390/economies11020045

37. Li, B., Guo, P., & Zeng, Y. (2019). The Impact of Haze on the Availability of Company Debt Financing: Evidence for Sustainability of Chinese Listed Companies. *Sustainability, 11,* 806. https://doi.org/10.3390/su11030806

38. Lusardi, A., & Mitchelli, O. S. (2007). Financial literacy and retirement preparedness: Evidence and implications for financial education: The problems are serious, and remedies are not simple. *Business Economics, 42,* 35-44. Retrieved from https://link.springer.com/article/10.2145/20070104

39. MadfooatCom. (2023). *Who's who in Jordan banking, insurance, and financial services?* Retrieved from https://www.jordanfinancialservices.com/sites/default/files/pdf_2022_whos_who_in_jordans_banking_insurance_and_financial_services.pdf

40. Makarov, I., & Antoinette, S. (2022). Cryptocurrencies and Decentralized Finance. No. 1061. *Bank for International Settlements*. Retrieved from https://www.bis.org/publ/work1061.htm

41. Marei, A., Mustafa, J. A., Othman, M., Daoud, L., & Lutfi, A. (2023). The moderation of organizational readiness on the relationship between toe factors and fintech adoption and financial performance. *Journal of Law and Sustainable Development, 11*(3), e730-e730. Retrieved from https://doi.org/10.55908/sdgs.v11i3.730

42. Maurer, B. (2016). Re-risking in Realtime. On possible futures for finance after the blockchain. *Behemoth-A Journal on Civilization, 9*(2), 82-96. Retrieved from https://d-nb.info/1124004963/34

43. Mustafa, J. A., Marie, A., Al-Amarneh, A., & Al-Abbadi, A. (2023). *The Role of Fintech Payment Instruments in Improving Financial Inclusion.* Retrieved from https://www.naturalspublishing.com/files/published/i14855r12j665g.pdf

44. Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). *Bitcoin and cryptocurrency technologies: a comprehensive introduction.* Princeton University Press.

45. Natarajan, H., Krause, S., & Gradstein, H. (2017). *Distributed ledger technology and blockchain.* Retrieved from https://www.investopedia.com/terms/d/distributed-ledger-technology-dlt.asp

46. OECD. (2006). *The importance of financial education. The policy brief.* Retrieved from https://www.oecd.org/finance/financial-education/37087833.pdf

47. OECD. (2022). *Why Decentralised Finance (DeFi) Matters and the Policy Implications.* Retrieved from https://www.oecd.org/daf/fin/financial-markets/Why-Decentralised-Finance-DeFi-Matters-and-the-Policy-Implications.pdf

48. OXEPR. (2019). *Building FinTech Ecosystems: Emerging Trends & Policy Implications Insights from the 5th Annual Oxford Entrepreneurship Policy Roundtable (OXEPR).* University of Oxford. Retrieved from https://www.sbs.ox.ac.uk/sites/default/files/2020-09/OXEPR%202019%20%28Building%20FinTech%20Ecosystems%29.pdf

49. Pazaitis A., De Filippi P., Kostakis V. (2017). Blockchain and value systems in the sharing economy: the illustrative case of Backfeed. *Technological Forecasting and Social Change, 125,* 105-115. https://doi.org/10.1016/j.techfore.2017.05.025

50. Prabhakaran, S., & Mynavathi, L. (2023). Perception vs. reality: Analysing the nexus between financial literacy and fintech adoption. *Investment Management and Financial Innovations, 20*(4), 13-25. http://dx.doi.org/10.21511/imfi.20(4).2023.02

51. Price, D. (2018). *5 Big Blockchain Issues: Security, Privacy, Legal, Regulatory, and Ethical.* Retrieved from https://blocksdecoded.com/Blockchain-issues-security-privacy-legal-regulatory-ethical

52. Sahi, S. K. (2009). Financial literacy education for the Indian consumer: the road to economic development. *International Journal of Indian Culture and Business Management, 2*(5), 493-518. http://dx.doi.org/10.1504/IJICBM.2009.025277

53. Se, J. (2023). The Influence of Financial Literacy on Financial Inclusion in Indonesia with Fintech as a Mediator. *Inovbiz: Jurnal Inovasi Bisnis, 11*(1), 103-109. Retrieved from http://ejournal.polbeng.ac.id/index.php/IBP/article/view/3264

54. Shamli Prabhakaran, & Mynavathi, L. (2023). Perception vs. reality: Analysing the nexus between financial literacy and fintech adoption. *Investment Management and Financial Innovations, 20*(4), 13-25. https://doi.org/10.21511/imfi.20(4).2023.02

55. The Regulatory Horizons Council (RHC). (2021). *The Future of Technological Innovations and the Role of Regulation.* Retrieved from https://assets.publishing.service.gov.uk/media/611259bbd3bf7f044630abb9/rhc-future-technological-innovations-role-regulation.pdf

56. The World Bank. (n.d.). *Open Data. (2011–2023).* Retrieved from https://data.worldbank.org/

57. Treleaven, P, Gendal Brown, R, & Yang. D, (2017). Blockchain Technology in Finance. *Computer, 50*(9), 14-17. https://doi.org/10.1109/MC.2017.3571047

58. TU-T Focus Group Digital Financial Services. (2016). *The Digital Financial Services Ecosystem. Telecommunication standardization sector of ITU* (Technical Report).

59. Van Rooij, M., Lusardi, A., & Alessie, R. (2011). Financial literacy and stock market participation. *Journal of Financial Economics, 101*(2), 449-472. https://doi.org/10.1016/j.jfineco.2011.03.006

60. Vidovićová, L. (2021). Financial Literacy. In D. Gu & M. E. Dupre (Eds.), *Encyclopedia of Gerontology and Population Aging*. Cham: Springer. https://doi.org/10.1007/978-3-030-22009-9_193

61. Widyastuti, M., & Hermanto, Y. B. (2022). The effect of financial literacy and social media on micro capital through financial technology in the creative industry sector in East Java. *Cogent Economics & Finance, 10*(1). https://doi.org/10.1080/23322039.2022.2087647

62. Wiradinata, T., Herdinata, C., Christian, S., & Setiobudi, A. (2022). Accelerating electronic wallet payment service adoption in Indonesian small and medium-sized businesses. *International Journal of Information Systems and Change Management, 13*(1), 3-18.

63. World Bank. (n.d.). *Global Financial Development Report 2019 / 2020: Bank Regulation and Supervision Ten Years after the Global Financial Crisis.* Retrieved from https://documents1.worldbank.org/curated/en/685851571160819618/pdf/Bank-Regulation-and-Supervision-Ten-Years-after-the-Global-Financial-Crisis.pdf

64. Yakoboski, P., Lusardi, A., & Hasler, A. (2023). *Financial literacy, longevity literacy, and retirement readiness* (TIAA Institute Research Paper Series No. Forthcoming). Retrieved from https://www.tiaa.org/public/institute/publication/2023/financial_literacy_longevity_literacy_and_retirement_readiness#:~:text=Financial%20literacy%20and%20longevity%20literacy,retirees%20with%20low%20financial%20literacy

65. Yoshino, N., Morgan, P. J., & Long, T. Q. (2020). Financial literacy and fintech adoption in Japan. *ADBI Working Paper Series, 1095.* Retrieved from https://www.adb.org/sites/default/files/publication/574806/adbi-wp1095.pdf

66. Yue, P., Korkmaz, A. G., Yin, Z., & Zhou, H. (2022). The rise of digital finance: Financial inclusion or debt trap? *Finance Research Letters, 47,* 102604.

67. Zhu, H., & Zhou, Z. Z. (2016). Analysis and outlook of applications of blockchain technology to equity crowdfunding in China. *Financial Innovation, 2,* 1-11.

http://dx.doi.org/10.21511/imfi.21(2).2024.17