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The Mediating Impact of Organizational Innovation on the Relationship Between Fintech Innovations and Sustainability Performance

Nashat Ali Almasria ^{1,*}, Zaidoon Alhatabat ², Diala Ershaid ², Abdulhadi Ibrahim ¹ and Sajeel Ahmed ³

¹ Accounting and Finance Department, College of Business Administration, A'Sharqiyah University, P.O. Box 42, Ibra 400, Oman; abdulhadi.ibrahim@asu.edu.om

² Accounting Department, Business Faculty, Arab Open University, Amman 11953, Jordan; z_hutaibat@aou.edu.jo (Z.A.); d_ershaid@aou.edu.jo (D.E.)

³ Business School, University of Bedfordshire, University Square, Luton LU1 3JU, UK; sajeel.ahmed@beds.ac.uk

* Correspondence: nashat.almasria@asu.edu.om

Abstract: The paper explores the impact of digital payment systems, blockchain technology, and AI/machine learning on innovation and sustainability in financial organizations. As part of the analysis, the study has adopted an explanatory research design and has used SmartPLS in order to analyze the data collected from 230 professionals of different fields through a structured questionnaire. The results show positive effects of digital payment systems and blockchain technology on organizations' innovations with the impact of digital payments being the most pronounced. Empirical results suggest that these technologies are important to improve sustainability performance, depending on measures of internal consistency and discriminant validity among the proposed constructs. AI, also machine learning, has the highest relevance with environmental sustainability, thereby underlining the importance and work of such measures. Based on the Resource-Based View (RBV) theory, the study also explains the need for the organization to assimilate these innovations to enhance the organizational operations, customer satisfaction, and compliance with the laws. The study highlights fintech's potential to address environmental issues and enhance societal goals, but geographical limitations may obstruct its transportability.

Keywords: artificial intelligence; blockchain technology; digital payment systems; organizational innovation; environmental sustainability



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1. Introduction

The world of modern finance is entering a new phase of development, akin to the Industrial Revolution 4.0, focusing on innovation and fintech [1]. The 4th Industrial Revolution takes attributes from the use of a variety of technologies within digital lists, including artificial intelligence, IoT, and blockchain [2]. Fintech that uses technology intervenes with the conventional banking system is making a great breakthrough in making financial services efficient and sustainable [3,4]. The Resource-Based View (RBV) theory can explain the role of the implementation of fintech technologies and organizational innovation [5]. AI helps in decision making and in smoothening processes and blockchain offers a decentralized and authentic strategy for trust as well as responsibility [6]. Mobile payments reform payments, make them cheaper, and improve customer interactions, advancing innovation that supports sustainability efforts [7]. And this connection proves the role that fintech takes in providing for the organizations' resilience and sustainable development.

Fintech and sustainability are interconnected, with fintech enhancing efficiency and sustainable practices, while traditional banking models are being transformed to enhance sustainability outcomes [8,9]. Fintech and sustainability are the two trends that influence

the financial services industry, combining services with sustainable solutions [10,11]. Moreover, it has been observed that data protection, encryption, autonomous, and decentralized structures ensure that systems are protected, secure, and accountable and drive the sustainable development of the global economy [12,13]. Fintech enhances both exploratory and exploitative innovation capabilities, and organizational resilience moderates these relationships [14]. AI-based fintech enhances sustainable finance, credit rating trustworthiness, and financial conditions by integrating mobile payment, equity crowdfunding, lending services, and blockchain-based supply chain financing [15–17].

The modern technologies introduced in the field are redesigning the process of entrepreneurial development, especially in the financial industry, enabling sound structures for banks as well as startups through the use of fintech [18]. Fintech can thus play a very vital role in the achievement of sustainable development by improving financial services and practicing sustainable development when applied properly [19]. Fintech, a technology-driven approach, combines financial services with sustainable development to create a more inclusive, efficient, and environmentally responsible economic system [20]. Legowo stated that technology is the most significant business driver in the financial sector, followed by money flow and organization, with 68.8% of respondents identifying it as such [21,22].

Fintech and environmental sustainability are increasingly important in the sector of banking and asset management, with governments promoting green finance and sustainable banking to improve sustainability [23,24]. Fintech is a critical advancement in the financial industry, utilizing computer programs and information technology to streamline traditional financial services [25]. Process-related indicators and sustainable performance outcomes resulting from fintech implementation, highlight the under researched intersection of digitalization and sustainability in the financial services industry [8]. The rise in fintech has significantly transformed the traditional banking model by introducing digital transformation and transforming the delivery of financial services [26]. Fintech innovation aims to make financial services easier, cheaper, and better available [27]. Technological innovations disrupt financial services, enhancing efficiency and reducing costs. Contrastingly, it has been argued that Wang that fintech startups face competition from traditional providers, while Industry 4.0 is heavily influenced by fintech innovations, leading to a single global transaction medium [28].

Digital payment systems are vital for modern businesses to enhance transaction processes, enhance customer satisfaction, and reduce costs, thereby ensuring market competitiveness [29,30]. Digital payment systems are essential for modern businesses to improve transaction processes, customer satisfaction, and reduce operational expenses, thereby enhancing competitiveness in the dynamic market [31]. Also, electronic payments, excluding physical cash, are gaining popularity due to advancements in technology, smartphone usage, online services, and regulatory support [32,33].

Blockchain technology can improve organizational processes by enabling transparency, security, and accountability [34]. It can increase trust among stakeholders, reduce fraud, and help organizations achieve sustainability objectives by enhancing supply chain management.

Industry 4.0 emphasizes technology in all fields, with blockchain technology promising significant improvements in business operations [35,36]. Blockchain and ICOs (Initial Coin Offerings) disrupt SCF (Supply Chain Finance), offering innovative financing beyond conventional capital, providing new opportunities for SMEs (Small and Medium-sized Enterprises) to capitalize and leverage on digital technology [37]. In contrast, AI and ML are being utilized in advanced analytics for innovation development, enabling organizations to analyze data, improve resource utilization, and enhance products in response to changing consumer perceptions and environmental changes [38]. AI is significantly altering the process and outcomes of digital innovation due to its unique nature and ontology [39–41]. Also, it has been observed that companies are embracing AI in fintech to replace humans and guide the transition to a digital organization of innovation [40,42]. It has been observed that financial institutions partner with fintech companies to acquire technologies [43].

KPMG reports a 147% increase in global fintech investment to \$210 billion in 2021, with Asia Pacific contributing \$27.5 billion and 183,511 fintech companies registered in China [44]. Also, Oman is rapidly adopting fintech in both public and private sectors, leveraging technological advancements to enhance financial performance [45]. To justify this, it has been observed that the decentralization of blockchain offers security, transparency, and controllability, impacting fintech application performance and growth. Understanding these factors is crucial for understanding the influence of blockchain on financial performance in Oman and its application in fintech adoption. Moreover, is it important to consider fintech innovations and financial literacy on enhancing sustainability performance through improved access to finance [46]. Most of the firms are rapidly advancing in the financial services sector, utilizing innovative technologies and business models to enhance payment solutions and meet customer needs [47]. However, the use of fintech in sustainable development urge regulators and governments to develop digital financial transformation strategies for financial inclusion and sustainability [48,49]. It has also been observed that fintech has the potential to revolutionize the rapidly growing economies worldwide as the role of fintech is capable enough to enhance organizational innovation [50]. Fintech utilizes innovative ideas to propose technology solutions that enhance financial services in various business situations, introducing new business approaches [51]. The integration in digital payments is transforming transactions into a secure, convenient, and interconnected ecosystem for the enhancement of the organization [52]. In most of the industrial parts, fintech promotes innovation and competition in the financial sectors, forcing traditional banks to adapt and enhance their services to remain competitive and provide better consumer offerings [53].

This paper focuses on analyzing the impact of digital payment systems, blockchain technology, AI/machine learning, and fintech innovations on organizational innovation. Most of the previous studies have covered different variables but these variables together were not analyzed based on the mediating role of organizational innovation in the relationship between innovation and environmental sustainability. However, the study is useful for policymakers and stakeholders by establishing the relationship between fintech and sustainability performance, enabling the development of sustainable fintech solutions that promote environmental sustainability and social justice.

2. Literature Review

2.1. *Organizational Innovation and Its Impact on Environmental Sustainability: Exploring Mediating Effect*

Digital payment systems have therefore come out as one of the most revolutionary inventions that have affected the business world along with organizational change [54]. Emerging market technologies are driving companies to increasingly adopt digital payment solutions to enhance performance and client satisfaction [55]. The integration of enabled systems like mobile wallets, online payment systems, and contactless payments not only streamlines the financial industry but also fosters innovation across various sectors [56,57]. Real-time data collection and analysis is one of the main avenues through which a digital payment system promotes organization innovation [58,59]. Real-time transactions allow firms to understand consumer behavior, enabling targeted marketing strategies and improved customer relationships, fostering innovation and quick market response [60]. E-payment impacts business operations, challenging new models. However, organizations can improve service delivery, minimize transaction costs, and focus on cash flow management through various strategies [31,61].

Digital payment eliminates hindrances in normal payments, accelerating revenue cycles, increasing profitability, and potentially enabling research and development of new products and services. However, it also consolidates collaboration between departments and partners [62,63].

Financial systems integrate people, facilitating clear communication and initiative creation through collaborative teamwork. This fosters creativity and innovative improve-

ments through the exchange of ideas and materials [64]. Digital payment systems improve customer experiences, foster innovation, and increase accessibility, while ensuring safety nets like encryption and fraud detection, fostering trust and adoption of new products and services [62,65]. Digital payment systems enable businesses to expand into new markets, eliminate physical constraints, and create innovative solutions through new products, payment options, and localized services [66]. The RBV theory has emphasized the importance of organization resources for competitive advantage and innovation [67]. However, digital payment systems can streamline the processes, facilitate the data driven decision, and foster sustainable practices with environmental sustainability goals, while also enhancing innovation outcomes.

H₁. *Digital payment systems positively influence organizational innovation, and organizational innovation mediates the relationship between digital payment systems and environmental sustainability.*

2.2. Impact of Blockchain Technology on Sustainability

Blockchain is an electronic payment system that ensures payment security regardless of the participants in the transaction [63,68]. Also, most of the large corporate companies are utilizing blockchain technology to provide a decentralized and transparent method for investors to verify their capital usage [69]. Moreover, in fintech, blockchain startup companies can boost their revenue through initial coin offerings [70,71]. Fintech and blockchain enable access to new sources of finance, bypassing traditional intermediaries, and enabling effective monitoring, reporting, and verification [72]. In the Middle East, causal relationships between blockchain and fintech innovation continuance-use intention offer insights for managers to foster sustainable growth, improve IT quality, reduce risks, and build user trust [73]. Fintech innovations optimize resource management, enhance citizen engagement, and foster collaborative governance [74]. The use of digital ecosystems to enhance trust in inter-organizational business processes, causes the utilization of a practical industrial case study and recommends future blockchain technology developments [75]. Most of the studies have shown the positive impact of blockchain technology on organizational sustainability, highlighting its role in morality, ethics, and governance, and provides insights for practitioners and policymakers on successful adoption. According to the RBV theory, blockchain technology can be considered as a valuable resource because it can improve the transparency, security, and efficiency in the processes [76]. However, this has led to the development of innovations with underlying economic sustainability framework and promotes commercial sustainable practices and sustainable business models which address the deficit between innovation and sustainability.

H₂. *Blockchain technology positively influences organizational innovation, and organizational innovation mediates the relationship between blockchain technology and environmental sustainability.*

2.3. AI and Machine Learning in Innovation and Sustainability

Fintech, a term referring to the use of information technology to enhance traditional business models and provide financial services, is crucial for global business operations [77]. Machine learning and AI platforms are crucial for organizations to monitor progress and increase revenue [78,79]. Big data platforms like Hadoop and Spark enable businesses to efficiently store, process, and analyze large datasets, revolutionizing predictive analytics [80,81]. Moreover, the integration of sustainability practices in digital accounting and finance focuses on AI-enabled fintech. This highlights its transformative impact on sectors like healthcare, finance, and transportation, emphasizing the need for a comprehensive study [82]. The digital economy is evolving due to technology and money, promoting sustainable behaviors and innovative financial solutions. Circular economic concepts and fintech innovations, like blockchain and AI, aim to build a resilient economy and encourage environmentally conscious investment. However, the digital revolution is transforming economic dynamics [83]. The framework suggests a harmonious link between data science and

fintech, focusing on AI ethics, regulation technology, and smart data utilization, resulting in substantial organizational benefits [84]. RBV focuses on resources that are valuable, rare, inimitable, and non-substitutable such as AI and machine learning for competitive edge, propelling innovation, improving processes, and sustainability for superior performance and resilience [85].

H₃. *AI and machine learning technologies enhance organizational innovation, and organizational innovation mediates the relationship between AI and machine learning and environmental sustainability.*

2.4. Linking Organizational Innovation to Sustainability Performance

The relationship between financial literacy, digital transformation, fintech adoption, competitiveness, and sustainable firm performance, demonstrates that financial literacy significantly influences these factors, thereby enhancing sustainable performance [86]. It has also been found that e-payment on Indonesian MSMEs' supply chain performance has shown positive effects in digitization [87]. Moreover, fintech on economic performance in MENA zone countries during political instability suggests that lending activities can increase inflation, but can be moderated [88].

Fintech is a key driver of positive changes in the financial industry, utilizing modern technologies and innovative solutions. It aligns technologies, data, and customer-focused strategies, enhancing efficiency and contributing to sustainability goals [89,90]. Fintech companies, particularly in emerging markets, can enhance their operations while promoting sustainability [91]. Fintech industry sustainability is achieved through innovation, sustainable financial products, and environmentally friendly investments, with fintech companies offering online marketplaces for investors to fund sustainability schemes [92,93].

Fintech companies can enhance sustainability by incorporating blockchain technology in auditing, enhancing transparency, accountability, and reducing fraud cases, thus saving paper and energy [94,95]. The services offered in fintech can incorporate data analytics that enable an evaluation of sustainability balances and decision making, leading to the achievement of improved sustainability status of the supply chain management [96]. Through the data analytics, fintech services will be able to determine sustainability balances, decision making, and benchmarking of supply chain management resulting in a boost in overall sustainability status of a country [96]. The RBV framework specifically puts a focus on an organization's resources and capabilities that can make it distinct from other firms [97]. There is a need to perform organizational innovation, where the culture of innovation will allow sustainable practices, regulation, and consumers demands.

H₄. *Organizational innovation positively influences environmental sustainability.*

2.5. Model Construction

Based on the method to identify the mediating role,, this paper examines the mediating role of organizational innovation between environmental sustainability with digital payment, blockchain technology, and AI and machine learning. With the help of smart pls, analysis was performed. The overall framework of the research has been represented in Figure 1. The study has analyzed the relation of digital payment, blockchain technology, organizational innovation, environmental sustainability, and AI and machine learning. The arrows indicate whether one concept affects another, or is affected by the other, in other words cause or effect.

The study has observed a strong relationship between digital payment and blockchain technology, with a coefficient 0.372 which means a strong positive relationship between two variables. Blockchain technology also seems to have an impact on organizational innovation, with a coefficient estimate of 0.188. Further, AI and machine learning are correlated with organizational innovation with a correlation of 0.182. The conceptual model indicates the types of technological and organizational factors which help in addressing the relation between environmental sustainability and human activities requires further research.

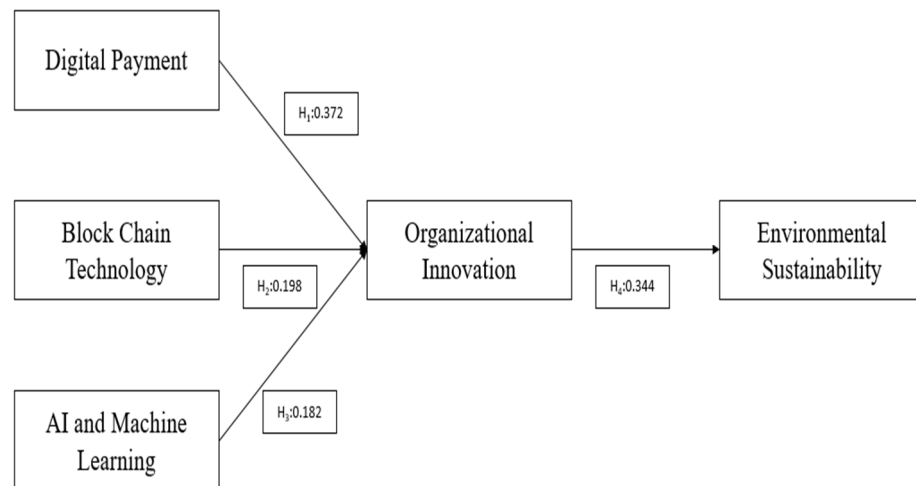


Figure 1. Research framework. Source: (Author made).

3. Materials and Methods

3.1. Research Design

The study has used explanatory research design in order to explore the mediating impact between fintech innovations, organizational innovation, and environmental sustainability. The study has applied Smart PLS and performed a survey-based approach and structured questionnaire in order to collect numerical data for statistical analysis. With the help of 5 Likert scale as the measurement instrument, which is a psychometric measuring instrument prevalent in social sciences research contextualizing its validity, reliability, and analysis [98]. A structured questionnaire employing a 5 point Likert scale to capture respondents' attitude towards fintech and sustainability was utilized. Its particular stages of development and validation do not have a comprehensive description. This might increase the reliability and validity of the instrument by showing that it properly measures the interconnectedness between fintech innovations to attain sustainability, and the results of the research might increase the readers' trust in the study.

3.2. Questionnaire Development

The close-ended questionnaire covers variables related to digital payment, blockchain technology, AI and machine learning, organizational innovation, and environmental sustainability. Each variable is evaluated through a set of indicators; however, respondents are asked to indicate their level of agreement on a 5 point Likert scale ranging from "Strongly Agree" to "Strongly Disagree".

For digital payment, the statements assess the respondents' regular use of digital payment methods, the convenience and time-saving benefits, and the level of trust in the security measures of digital payment platforms.

The blockchain technology section evaluates the perceived impact on the security and transparency of financial transactions, as well as the respondents' familiarity with how blockchain technology operates in financial services.

The AI and machine learning section explores the respondents' perceptions on the efficiency improvements of digital payment platforms, the confidence in AI's ability to detect and prevent fraud, and the personalization capabilities of machine learning algorithms.

The organizational innovation section focuses on the organization's adoption of innovative technologies, the role of innovation in achieving business goals, the culture of innovation, and the investment in research and development.

Finally, the environmental sustainability section investigates the organization's consideration of the environmental impact when adopting new technologies, the perceived contribution of fintech innovations to reducing environmental impact, and the implementation of sustainable and eco-friendly business practices.

The use of the Likert scale allows the respondents to express the degree of their agreement or disagreement with each statement, providing valuable insights into their perceptions and experiences related to these various aspects.

3.3. Research Approach

The study uses SmartPLS to analyze the connections between digital payment systems, blockchain technology, AI, innovation, and sustainability in the fintech industry, providing insights into how innovation enhances sustainability performance [99]. Further, a deductive approach is used in order to analyze the relationship among fintech adoption, organizational innovation, and sustainability outcomes in using a SEM (Structural Equation Modeling) approach through Smart PLS.

3.4. Data Collection

A study surveyed 230 finance, technology, and sustainability professionals while using a structured survey questionnaire in order to analyze the perception of fintech innovation, organizational innovation and environmental sustainability, as shown in Table 1. Also, the survey included Likert scale items ranging from 1 to 5, ensuring diversity across the industries and demographics. The study has analyzed fintech innovations and sustainability practices using 230 respondents from various sectors, including technology, finance, healthcare, and education. Purposive sampling ensured a diverse group of professionals and individuals familiar with fintech technologies [100]. The study explores fintech innovations, organizational innovation, and environmental sustainability using a structured questionnaire and Structural Equation Modeling, analyzing process improvement, resource utilization, and waste reduction.

Table 1. Demographics analysis.

Demographic Variable	Categories	Frequency (n)	Percentage (%)
Gender	Male	120	52.20%
	Female	110	47.80%
Age	18–24	45	19.60%
	25–34	85	37.00%
	35–44	60	26.10%
	45–54	40	17.40%
Educational Level	High school or equivalent	20	8.70%
	Bachelor’s degree	110	47.80%
	Master’s degree	70	30.40%
	Doctorate or equivalent	30	13.10%
Employment Status	Employed	130	56.50%
	Self-employed	45	19.60%
	Unemployed	20	8.70%
	Student	25	10.90%
	Retired	10	4.30%
Industry	Technology	70	30.40%
	Finance	60	26.10%
	Healthcare	40	17.40%
	Education	35	15.20%
	Other	25	10.90%

Table 1. Cont.

Demographic Variable	Categories	Frequency (n)	Percentage (%)
Years of Work Experience	0–2 years	30	13.00%
	3–5 years	50	21.70%
	6–10 years	70	30.40%
	11–15 years	40	17.40%
	16+ years	40	17.40%

Source: (Author made).

3.5. Demographics

The respondents in the study formed a sample of 230 and in terms of demographic characteristics the results were fairly spread out with 52% male and 47.8% female. About half of them are young and mid-aged with 47 years being the median age. Of the total, 8% possessed a Bachelor's degree, 30.4% a Master's, and 13.1% a doctorate. A smaller proportion (8.7%) had completed high school, highlighting that most of the sample is highly educated. Regarding employment status, the majority (56.5%) are employed, while 19.6% are self-employed. A smaller percentage of respondents are unemployed (8.7%), students (10.9%), or retired (4.3%). The industry representation shows that 30.4% of respondents work in the technology sector, followed by 26.1% in finance, 17.4% in healthcare, 15.2% in education, and 10.9% in other sectors. This suggests a strong presence of professionals from the technology and finance sectors in the sample. Finally, the years of work experience indicate that 30.4% of the respondents have 6–10 years of experience, followed by 21.7% with 3–5 years, and 13% with 0–2 years. Respondents with over 10 years of experience make up 34.8% (11–15 years and 16+ years), indicating a diverse range of professional experience across the sample. Regarding the effect of fintech on sustainability in different professions, the study's results could be further improved by investigating the demographic characteristics and differences by categories, as well as providing meaningful recommendations to the interested stakeholders of the fintech industry.

4. Empirical Evidence of Sustainability and Innovation

The analysis of the relationships between various technological innovations and their impacts on sustainability and organizational innovation reveals significant insights, as shown in Table 2. The mean values indicate the average effect of each variable, with "Digital payment → Organizational innovation" showing the highest mean (0.372), suggesting a strong positive influence. Electronic payment systems significantly improve the organization's innovation, which is critically important in today's constantly changing environment.

Table 2. Empirical evidence of sustainability and innovation.

Variables	Mean	Standard Deviation	T Statistics	p Value
AI and machine learning → Environmental sustainability	0.062	0.028	2.254	0.024
AI and machine learning → Organizational innovation	0.182	0.065	2.784	0.005
Blockchain technology → Environmental sustainability	0.068	0.028	2.468	0.014
Blockchain technology → Organizational innovation	0.198	0.068	2.91	0.004
Digital payment → Environmental sustainability	0.128	0.032	3.971	0
Digital payment → Organizational innovation	0.372	0.062	5.964	0
Organizational innovation → Environmental sustainability	0.344	0.056	6.115	0

Source: (Author made).

The T statistics also indicate the significance of these relationships more so the negative coefficients for the independent variables. The closer the T statistic is to 1 the better is the correlation Hence, the relationship between "Organizational innovation → Environmental

sustainability” has the largest T statistic 6.115. From this it can be inferred that organizational innovation which is an aspect of organizational environment has a high possibility of being effective in increasing environmental sustainability, showing that these two aspects are integrated. P values are used to show the level of statistical significance, any figure below 0. The study shows a significant value against the null hypothesis, with a value of 0.05 for digital payment relationships. This indicates that technological developments are crucial for achieving sustainability and innovation. Therefore, businesses should focus on digital payment systems and encourage innovation to support sustainability and improve sustainable business models.

5. Mean, Standard Value and *p*-Value

The findings show that there are positive correlations between the examined constructs. The study in Table 3 found that both AI and machine learning exhibit a small, but statistically significant, sample mean effect of 0.074 on environmental sustainability and 0.214 on organizational innovation ($p < 0.001$). The influence of a blockchain is stronger, which is supported by mean effects of 0.142, which are significant ($p < 0.001$) for both environmental sustainability and 0.409 for organizational innovation. Moreover, analysis of the results has established that organizational innovation significantly and positively impacts on environmental sustainability (mean = 0.345, $p < 0.001$). These studies imply that both AI and blockchain are the essential tools for improving the organizational innovation and sustainability in operations.

Table 3. Reliability and Validity Analysis.

Categories	Sample Mean (M)	Standard Deviation (STDEV)	<i>p</i> Values
AI and machine learning → Environmental sustainability	0.074	0.022	0.001
AI and machine learning → Organizational innovation	0.214	0.055	0.000
Blockchain technology → Environmental sustainability	0.142	0.028	0.000
Blockchain technology → Organizational innovation	0.409	0.052	0.000
Organizational innovation → Environmental sustainability	0.345	0.051	0.000

Source: (Author made).

6. Reliability and Validity Analysis

Cronbach’s Alpha value of all the constructs were scrutinized and all presented acceptable values which ensure that the respective construct examined the same concept with consistency, as shown in Table 4. Composite reliability values were above the recommended level, which pointed towards the fact that there was high internal consistency. The Average Variance Extracted (AVE) values were higher than 0, stating that the current model seems to have high predictive power. There were 5 thresholds to support the assertion that explain more than 50% of the variance in the construct. The items under each construct had reasonable convergence to the respective construct, with digital payment the most reliable at 0.875.

Table 4. Reliability and validity analysis.

Construct	Cronbach’s Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)	Convergent Validity (Loadings > 0.5)	Discriminant Validity (AVE > Squared Correlations)
AI and Machine Learning	0.77	0.788	0.852	0.59	Yes	Yes
Blockchain Technology	0.786	0.807	0.859	0.603	Yes	Yes
Digital Payment	0.81	0.814	0.875	0.637	Yes	Yes
Environmental Sustainability	0.794	0.806	0.866	0.619	Yes	Yes
Organizational Innovation	0.794	0.797	0.857	0.544	Yes	Yes

Source: (Author made).

7. Fornell–Larcker Criterion

Fornell–Larcker criterion depicted above in Table 5 help in understanding the discriminant validity of the studied constructs. The numbers at the diagonal are the square root of the Average Variance Extracted (AVE) of each construct to show the communality of each construct, meaning how much of each construct is accounted for variance. For example, AI technological advancement as perceived by the use of analytical and machine learning has an AVE of 0.768, the AVE of digital payment is 0, and the AVE of environmental sustainability is 0.798 and 0. The coefficients of each sub-scale were =0.589 and 787, respectively; these high numbers prove high construct validity. On the other hand, the values of the correlation between the constructs are less than the square root of their AVE, which portrays satisfactory discriminant validity. For instance, the relation to the developments of blockchain technology and AI and machine learning is 0.445, which is below the 0.777 AVE for blockchain technology let alone for blockchain technology itself. Nonetheless, the AVE that we obtained with organizational innovation is slightly lower than that of the individual innovation, 0.738, and the correlations of the other constructs with it is 0. Digital payment was 475 with and environmental sustainability 0.344 was; according to the authors, it measures some level of variance but it seems to be measuring the same thing with the other constructs. Altogether, these results support the assertion that the constructs are distinct and clear, though care may be required to preserve the specificity of organizational innovation as part of the model.

Table 5. Fornell–Larcker criterion analysis.

AI and Machine Learning	Blockchain Technology	Digital Payment	Environmental Sustainability	Organizational Innovation	
AI and machine learning	0.768				
Blockchain technology	0.445	0.777			
Digital payment	0.326	0.221	0.798		
Environmental sustainability	0.53	0.441	0.43	0.787	
Organizational innovation	0.391	0.362	0.475	0.344	0.738

Source: (Author made).

8. Cross-Loadings Matrix

The cross-loadings data in Table 6 helps understand the measurement validity of constructs like AI technology, blockchain technology, digital payment systems, environmental sustainability, and organizational innovation. Items with high loadings show strong relationships with these constructs. Blockchain technology items have high loadings, indicating its application. Digital payment items show a clear link between money transmission and digital payment systems. Environmental sustainability items have high loadings, particularly in ES1. Organizational innovation items have clear loadings, with OI2 having the highest. The findings suggest significant differentiation across constructs, but constant cross-loadings are needed to avoid large overlaps.

Table 6. Cross-loadings matrix analysis.

Item	AI and Machine Learning	Blockchain Technology	Digital Payment	Environmental Sustainability	Organizational Innovation
AI1	0.733				
AI2	0.822				
AI3	0.783				
AI4	0.730				

Table 6. Cont.

Item	AI and Machine Learning	Blockchain Technology	Digital Payment	Environmental Sustainability	Organizational Innovation
BCT1		0.811			
BCT2		0.773			
BCT3		0.725			
BCT4		0.795			
DP1			0.769		
DP2			0.779		
DP3			0.827		
DP4			0.815		
ES1				0.855	
ES2				0.804	
ES3				0.754	
ES4				0.728	
OI1					0.734
OI2					0.749
OI3					0.739
OI4					0.758
OI5					0.709

Source: (Author made).

9. Correlations Matrix

The correlation matrix in Table 7 provides a detailed overview of the relationships between the constructs of AI and machine learning, blockchain technology, digital payment, environmental sustainability, and organizational innovation. The diagonal values, which equal 1, represent the perfect correlation of each construct with itself. The correlations among constructs reveal varying degrees of associations. Notably, environmental sustainability has the strongest correlation with AI and machine learning (0.530), suggesting that advancements in AI may significantly impact sustainable practices within organizations. Conversely, blockchain technology shows the weakest correlation with digital payment (0.221), indicating that while these constructs are related, their connection is not as strong as others. The correlations between organizational innovation and the other constructs range from 0.344 to 0.475, suggesting a moderate relationship where organizational innovation is influenced by factors such as digital payment and environmental sustainability but less so by blockchain technology.

Table 7. Correlations matrix analysis.

AI and Machine Learning	Blockchain Technology	Digital Payment	Environmental Sustainability	Organizational Innovation
AI and machine learning	1	0.445	0.326	0.53
Blockchain technology	0.445	1	0.221	0.441
Digital payment	0.326	0.221	1	0.43
Environmental sustainability	0.53	0.441	0.43	1
Organizational innovation	0.391	0.362	0.475	0.344

Source: (Author made).

Figure 2 shows the relationships between digital payment, blockchain technology, organizational innovation, and environmental sustainability. Digital payment systems enhance innovation, while blockchain technology has a positive impact. AI and machine learning indirectly influence innovation through other constructs. Organizational innovation leads to better environmental sustainability practices, and the path coefficient from innovation to sustainability is positive, but the effect size is relatively small. SEM has been employed in an effort to establish the direct associations between the different constructs. In particular, the values of path coefficients such as 0.372 between digital payment

and organizational innovation point to the degree of association between the given latent variables. These path coefficients will be computed and evaluated so as to establish the influence of the independent variables on the dependent variables that are direct. One of the most important concepts concerning the interpretation of results in both quantitative and qualitative research is effect size [101]. It offers an understanding of the significance of the findings that goes a notch higher than the significance tested. For example, the value of 0.372 is presented between digital payment and organizational innovation, which indicates moderate and a not very small effect size, which shows that the introduction of the digital payment system results in better organizational innovation. In evaluating the impact of the unconventional antecedents like AI and machine learning on innovation and sustainability, by controlling for the effect size or Cohen's f^2 , one is able to understand the strength of such relationships. However, a small p value means that although relationships exist, their impact may not be so significant.

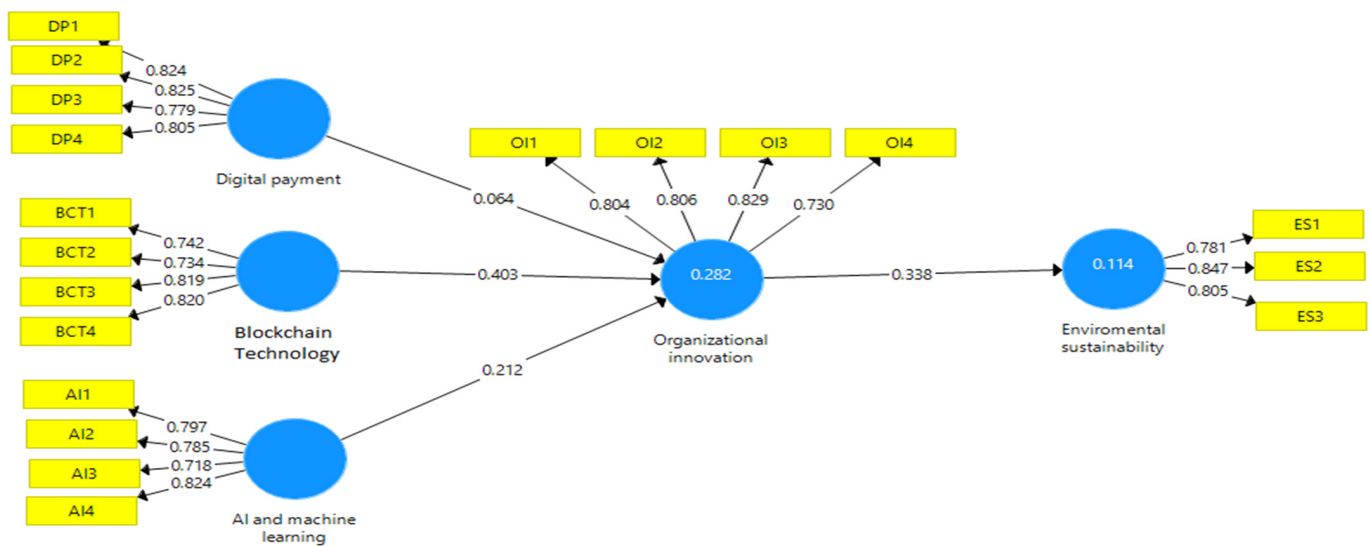


Figure 2. Relationships between digital payment, blockchain technology, organizational innovation, and environmental sustainability. Source: (Author made).

Empirical Evidence of Fintech's Impact on Innovation and Sustainability

Fintech is transforming innovation and sustainability, with advancements in AI and machine learning enhancing decision making and promoting sustainable business models [102]. Digital payment systems facilitate efficient transactions, reducing operational costs and minimizing resource reliance [103]. Blockchain technology enhances trust in financial transactions, encouraging sustainable investments [104]. It improves operational efficiency and innovation in fintech companies, contributing to improved sustainability performance, as studies show [105,106]. Fintech firms focusing on innovation and sustainability are well-positioned to tackle environmental issues like climate change and resource depletion, enhancing their competitive edge and societal goals [107,108]. Organizational innovation in fintech enhances the relationship between technological advancements and sustainability outcomes, enhancing operational efficiency and service delivery while enhancing sustainability through mediating influence [109]. Organizational innovation integrates technological capabilities into sustainable practices, like fintech's digital payment system, resulting in environmental benefits and aligning technology efficiency with sustainability goals [109]. Organizational innovation boosts stakeholder engagement, promoting sustainability in fintech companies [110]. Moreover, this has led towards collaboration, leading to the development of environmentally conscious products and services. Organizational innovation mediates a feedback loop, promoting sustainable practices and continuous improvement in both areas. Fintech companies' positive environmental results motivate further innovation [110]. Also, AI and machine learning enhance sustainability by optimiz-

ing resource use, reducing waste, and streamlining supply chains, leading to eco-friendly products and a more responsible business model [111]. Digital payment systems act as an effective tool for improving financial operations by decreasing costs and using real-time opportunities for designing new products and services, and developing customer-oriented strategies [112,113]. Moreover, blockchain technology enhances the level of organization transparency, security, and efficiency, and environmental protection and environmentally friendly activities decrease fraud and enhance collaboration [114,115].

Around 5000–6000 fintech startups compete in various market segments, including lending tech, money transfer, blockchain, and insurance, vying for market share [63,116]. Moreover, the money management strategies of low-income individuals in developing countries, comparing informal and formal methods, and discussing fintech innovations for better service is essential [117]. Digital payment systems have revealed themselves as innovative tools in the context of the business environment, which has a great impact on the processes of innovation and change [54]. The implementation of such strategies such as mobile wallets and contactless payments, among others, improves the company's performance as well as customer satisfaction [55]. Another important avenue for the generation of innovations is the possibility to collect the real-time data on their consumers and use them to promote the successful strategies for advertising campaigns [58,60]. Blockchain can well be described as an efficient and secure method of electronic payments, where safety of a transaction is not dependent on the other participants [68]. Most existing big businesses utilize blockchain technology in decentralizing and making capital validations more transparent [69]. In fintech, blockchain startups supplement the revenue through initial coin offerings [70,71]. In the same regard, blockchain enables access to other new financing and increases the monitoring and reporting capabilities [72]. In the Middle East, studies show that blockchain affects the fintech industry and clients' confidence to support continued development and better IT services [73]. Overall, blockchain positively impacts organizational sustainability. Further, it has been observed that many aspects of fintech are being revolutionized by blockchain technology, and it is equally important to determine how these networks interact with standard account systems to increase financial transparency, performance, and accuracy on financial statements as well as compliance with existing rules. The use of the blockchain can be gradually introduced into organizations starting with simple solutions such as supply chain tracking and gradually solving other problems to avoid disruption and the rejection of blockchain solutions by traditional stakeholders [118]. Blockchain technology improves data protection, information sharing, compliance, and economy for firms. It enhances the level of trust, reduces bureaucracy or the need to regain control, and complies with the regulation through smart contracts [119]. This greatly supports cost efficiency since it reduces intermediate parties and makes do with simple, direct processes.

Supply chain- and accounting-related transactions are also a useful background for the understanding of the role of blockchain in fintech. Permissioned blockchain are more ideal for accounting transactions, which are discreet and need to conform to regulatory policies while public blockchain are ideal for supply chain use [120]. Such understanding assists organizations in determining the right technology to use and therefore define their plans for adopting blockchain technology.

Also, digital payments, smart contracts, blockchain, and Artificial Intelligence have transformed the banking and finance sector [121]. Digital payment systems enhance effectiveness and increase customer satisfaction involving transaction activities through a process that helps in reducing the amount of time taken to process transactions [122]. The use of blockchain improves trust and the use of Artificial Intelligence and machine learning improves the decision making processes [123]. By analyzing such factors, an organization is well placed to adapt its approaches to take advantage of existing advantages. Artificial Intelligence when incorporated in the processing of digital payments can yield useful data relating to customer's personality relations hence increasing engagement and satisfaction [124]. Thus, the presented research approach provides helpful recommendations for

firms interested in sustainability and a competitive advantage in the context of continuously changing conditions.

Both AI and machine learning remain very crucial in the development of fintech services by improving the existing financial services with big data analytics and predictive analysis [77,79]. Through the implementation of big data platforms such as Hadoop and Spark, data are easily managed and analyzed in large volumes in organizations hence enhancing effectiveness of decisions and overall organizational performance [81]. Technological integration further supports the application of sustainable solutions in several industries such as the healthcare and the financial sectors and industries that are bound by circular economy principles [82,83]. Financial literacy and digital transformation strongly influence sustainable firm performance and the essential role of fintech adoption in emerging markets [86,91].

10. Theoretical Implication

The Resource Based View (RBV) emphasizes a firm's ability to create sustainable competitive advantages through resource heterogeneity and immobility, rather than solely focusing on strategic resources [125]. The theory has also emphasized the importance of resources, including fintech, digital payment systems, blockchain technology, and artificial intelligence, in driving innovation and operational efficiency. The study has aligned in facilitating sustainable practices and also improved environmental performance, enabling firms to establish a competitive position in an environmental market.

11. Implications

The study has suggested that businesses should integrate digital payment systems, blockchain technology, and AI to boost the innovation, operational efficiency, customer satisfaction, and competitiveness in fintech while also ensuring the regulatory practices. Artificial Intelligence and blockchain technology are being utilized in business innovation to improve practices, secure interactions, value development, proposal, business capture, organizational capacities, and staff skills [8,126].

Future research should seek to study the effects of these technologies on the organizational performance in a long-run sector besides the different business sectors. Thus, research on the synergic effect of the technology where for instance AI and blockchain can be used hand in hand for promoting sustainability could be more insightful. Furthermore, future research should not only focus on the cultural and regional impact for the adoption of such technologies but also their impact on actual business innovation that is generated consequent to it.

12. Conclusions

The study also demonstrates that innovation and sustainability in financial organizations were greatly influenced by digital payment systems, blockchain technology, and AI/machine learning. The study shows that digital payment systems have the most significant impact on organizational innovation with blockchain technology also being important for improving operational performance. Challenges such as environmental sustainability are also touched on by AI and machine learning in this context, stressing that financial institutions have no option other than to subscribe to the technologies as a way of enhancing customer satisfaction as well as legal requirements. Using the Resource-Based View (RBV) theory, this paper provides a vivid tour on the role of the strategic nature of fintech innovations for organizations and their ability to not only upgrade organizational capability but also tackle important environmental issues. However, the study realizes that some geographical constraints may limit the generalization of the findings across different regions. Future studies should therefore endeavor to establish the applicability of these technologies in different environments in order to affirm the findings. Altogether, the paper illustrates that fintech can significantly influence the promotion of sustainable practices

while meeting the goals of society and points out that fintech is the significant driver of the ongoing changes in the financial services domain.

13. Limitation

The most relevant method used in the study is self-administered surveys which can give rise to social desirability biases. However, despite the use of statistical tools, the research results may contain a certain level of subjectivity. These limitations call for additional studies that have applied the objective measures and have been conducted in various geographic and cultural settings. Moreover, the review presented in this paper has included the studies in various locations.

14. Future Research

Future research should explore additional mediating factors such as organizational culture, leadership styles, and employee engagement to comprehend the indirect connections between digital technologies and environmental sustainability.

Technology implementation in developing countries and emerging markets can provide insights into regional differences, enhancing the model's global applicability.

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