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The Impact of Blockchain Technology on Financial Reporting Practices in UAE

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A B S T R A C T

The motivation for conducting this study stems from the increasing interest in blockchain technology and its potential to revolutionize financial reporting practices. Given the UAE's progressive stance on technology adoption and its strategic initiatives to integrate blockchain across various sectors, this papre aims to explore the specific impacts of blockchain on financial reporting accuracy, transparency, and fraud reduction within the region. The population for the study includes financial reporting professionals, auditors, regulatory authorities, financial technology experts, and academics within the UAE. From this population, a representative sample was drawn to ensure diverse perspectives and comprehensive insights. The study tool utilized is a structured questionnaire designed to capture detailed information on the respondents' perceptions and experiences with blockchain technology in financial reporting. The questionnaire was rigorously tested for reliability and validity. The results of the study reveal strong positive correlations between blockchain technology and the accuracy $(O = 0.714)$, transparency $(O = 0.698)$, and fraud reduction $(O = 0.702)$ of financial reporting, with all relationships being statistically significant $(P < 0.000)$. These findings underscore the transformative potential of blockchain technology in enhancing financial reporting practices by providing an immutable, transparent, and tamper-proof ledger. Future contributions of this research include providing a robust empirical foundation for further studies on blockchain technology in financial reporting. It highlights the need for expanded research across different regions and contexts to validate the findings and explore the long-term impacts of blockchain adoption. Additionally, the study suggests practical recommendations for organizations in the UAE to leverage blockchain technology for improved financial reporting accuracy, transparency, and security, thereby fostering greater trust and efficiency in financial practices.

1. Introduction

The rapid evolution of technology has significantly transformed various sectors, including finance and accounting. One such ground-breaking innovation is blockchain technology, which has garnered immense

attention for its potential to revolutionize financial reporting practices (Abdennadher et al., 2022). In the context of the United Arab Emirates (UAE), a country known for its progressive stance on technology adoption, the impact of blockchain on financial reporting is particularly profound. Blockchain technology, characterized by its decentralized, transparent, and immutable nature, offers a promising solution to many of the challenges faced by traditional financial reporting systems. It ensures data integrity, enhances transparency, and provides real-time access to financial information, thereby improving the accuracy and reliability of financial statements. These features are particularly relevant for the UAE, which is striving to establish itself as a global hub for financial technology and innovation. In recent years, the UAE government has shown a strong commitment to embracing blockchain technology across various sectors. Initiatives such as the Dubai Blockchain Strategy and the Emirates Blockchain Strategy 2021 highlight the nation's ambition to leverage blockchain for enhancing efficiency and transparency in governmental and private sector operations (Parmoodeh et al., 2023). This strategic direction has significant implications for the financial reporting landscape in the UAE.

The adoption of blockchain technology in financial reporting can lead to a paradigm shift in how financial data is recorded, verified, and disclosed. Traditional financial reporting processes are often plagued by inefficiencies, errors, and the risk of fraud. Blockchain technology addresses these issues by providing a secure and tamper-proof ledger of transactions, which can be accessed and verified by all authorized stakeholders in real-time (Abdennadher et al., 2022). Moreover, blockchain's smart contract functionality can automate various aspects of financial reporting, such as compliance with regulatory requirements and the execution of financial transactions (Abdulla et al., 2022). This automation not only reduces the administrative burden on organizations but also ensures timely and accurate reporting, which is crucial for maintaining investor confidence and regulatory compliance. Moreover, in the UAE, where the financial sector is a critical component of the economy, the implementation of blockchain technology in financial reporting holds the promise of enhancing the overall transparency and accountability of financial markets. By adopting blockchain, organizations can gain a competitive edge through improved efficiency, reduced costs, and enhanced trust among stakeholders. This research aims to explore the impact of blockchain technology on financial reporting practices in the UAE. It will examine the current state of financial reporting in the region, identify the key challenges faced by organizations, and analyze how blockchain technology can address these challenges (Petratos et al., 2020). Furthermore, the study will assess the readiness of the UAE's financial sector for blockchain adoption and provide recommendations for a successful implementation. However, this paper seeks to contribute to the growing body of knowledge on blockchain technology and its implications for financial reporting, offering valuable insights for policymakers, regulators, and industry practitioners in the UAE.

2. Literature Review

The advent of blockchain technology has introduced transformative changes in various industries, with significant implications for financial reporting practices. Several studies have explored this impact within the context of the United Arab Emirates (UAE), revealing both opportunities and challenges associated with blockchain adoption in financial accounting and reporting. Abdennadher et al. (2022) conducted an exploratory study that examined the effects of blockchain technology on the accounting and assurance profession in the UAE. Their research highlighted the potential of blockchain to enhance transparency, accuracy, and efficiency in financial reporting. By offering a decentralized and immutable ledger, blockchain reduces the likelihood of errors and fraud, thus fostering greater trust among stakeholders in the financial information disclosed by organizations. Similarly, Parmoodeh et al. (2023) investigated the perceptions of auditors regarding the impact of blockchain technology in the UAE. Their study revealed that auditors are generally optimistic about blockchain's potential to streamline audit processes and improve the reliability of financial statements. However, they also pointed out the need for auditors to acquire new skills and adapt to the technological changes brought about by blockchain implementation. Further exploring the feasibility of blockchain technology, Abdennadher et al. (2022) assessed its implementation in the UAE financial markets. Their findings indicated that blockchain could significantly improve market efficiency by providing real-time transaction data and reducing the need for intermediaries. This study underscored the importance of regulatory support and technological infrastructure in facilitating the successful adoption of blockchain in

financial markets. In addition, Petratos et al. (2020) provided a broader perspective by reviewing the impact of blockchain technology on sustainability and business practices in Dubai and the UAE. They argued that blockchain's capability to enhance transparency and reduce transaction costs aligns well with the UAE's vision of becoming a global leader in financial technology. Their review suggested that blockchain could play a crucial role in promoting sustainable business practices through improved accountability and traceability. The disruptive potential of blockchain in accounting and auditing was further explored by Abdulla, Alfalasi, and Grassa (2022). Their exploratory study emphasized the need for accounting professionals to embrace blockchain technology to stay relevant in a rapidly evolving digital landscape. They highlighted that while blockchain offers numerous benefits, such as improved data integrity and audit trails, it also poses challenges related to data privacy and regulatory compliance. Moreover, Borhani et al. (2021) employed the Technology Acceptance Model (TAM) to examine how blockchain technology can improve financial reporting. Their research concluded that the perceived ease of use and usefulness of blockchain significantly influence its adoption among accounting professionals. They also noted that training and education are critical in overcoming resistance to change and ensuring successful implementation. Mahtani (2022) focused on the role of blockchain accounting systems in mitigating fraudulent practices. His study demonstrated that blockchain's transparent and tamper-proof nature makes it an effective tool for detecting and preventing fraud in financial reporting. This research contributed to the growing body of evidence supporting blockchain's potential to enhance the integrity and reliability of financial information.

In addition to the above studies, other researchers have explored various dimensions of blockchain technology's impact on financial reporting. For instance, Almashhadani and Almashhadani (2022) examined the broader impact of financial technology on banking performance in the UAE, while Ayedh et al. (2021) discussed the implications of cryptocurrency and blockchain on auditing and accounting practices in Malaysia, providing insights that are also relevant to the UAE context. However, the literature indicates that blockchain technology holds significant promise for transforming financial reporting practices in the UAE. However, successful adoption requires addressing challenges related to technological infrastructure, regulatory frameworks, and the need for continuous professional development among accounting and auditing professionals. The UAE's proactive approach to embracing blockchain technology positions it well to leverage these benefits and lead the way in innovative financial reporting practices.

3. Hypothesis Development

The purpose of this paper is to investigate and clarify the theories that underpin the connections between Blockchain Technology and Financial Reporting Practices in UAE. However, the construction of hypotheses is covered in the parts that follow. Here, each hypothesis is developed and supported by theoretical insights and current literature. However, blockchain technology, with its decentralized and immutable ledger, offers a robust solution to many of the inaccuracies plaguing traditional financial reporting systems. Abdennadher et al. (2022) highlight the potential of blockchain to reduce errors by ensuring that once data is recorded, it cannot be altered. This immutable nature of blockchain can ensure higher accuracy in financial statements, as all transactions are verified and recorded in real-time, eliminating the risk of manual errors and discrepancies. However, the accuracy improvements are contingent on the proper integration of blockchain with existing financial systems and the comprehensive training of accounting professionals to manage and utilize this technology effectively. Transparency is a critical aspect of financial reporting, essential for maintaining stakeholder trust and regulatory compliance. Blockchain's transparent ledger allows all authorized participants to view and verify transactions, thereby enhancing the transparency of financial data. Parmoodeh et al. (2023) discuss how auditors perceive blockchain as a tool that can provide real-time access to financial information, fostering greater trust and accountability. Despite these benefits, the transition to blockchain-based systems requires careful consideration of data privacy concerns and the establishment of clear guidelines to balance transparency with confidentiality.

Fraud in financial reporting is a pervasive issue that can have severe consequences for organizations and stakeholders. Mahtani (2022) illustrates how blockchain's tamper-proof nature can serve as a deterrent to fraudulent activities, as every transaction is recorded in a secure, unchangeable ledger. By providing a clear audit trail, blockchain technology makes it significantly more challenging to manipulate financial records

without detection. However, the effectiveness of blockchain in reducing fraud also depends on the extent to which all participants adhere to security protocols and the overall robustness of the blockchain infrastructure.

Auditing is traditionally a time-consuming process that involves extensive verification of financial records. Blockchain can streamline this process by providing auditors with real-time access to an unalterable record of transactions, as discussed by Abdulla, Alfalasi, and Grassa (2022). This can reduce the time and effort required for audits, leading to significant efficiency gains. Nevertheless, the shift to blockchain-based auditing requires auditors to develop new skills and adapt to a changing technological landscape. There may also be initial resistance to change, which organizations must address through training and change management initiatives. Moreover, the successful adoption of blockchain technology in financial reporting is heavily dependent on the regulatory environment. As noted by Abdennadher et al. (2022), regulatory support plays a crucial role in facilitating the implementation of blockchain by providing clear guidelines and frameworks for its use. In the UAE, initiatives such as the Dubai Blockchain Strategy and the Emirates Blockchain Strategy 2021 underscore the government's commitment to integrating blockchain technology across various sectors. However, the development of comprehensive regulatory standards that address the unique challenges of blockchain is essential to ensure its effective and widespread adoption.

The hypotheses developed for this paper are grounded in the transformative potential of blockchain technology as evidenced by existing literature. Blockchain's ability to enhance the accuracy, transparency, and efficiency of financial reporting, as well as its potential to reduce fraud, are well-supported by empirical research. However, the realization of these benefits is contingent upon several factors, including the adequacy of regulatory support, the readiness of technological infrastructure, and the willingness of organizations and professionals to embrace change. One critical aspect that emerges from the literature is the dual-edged nature of blockchain's transparency. While transparency is generally seen as a positive attribute, particularly in enhancing stakeholder trust, it also raises concerns about data privacy and the protection of sensitive financial information. Balancing these two aspects will be crucial for the successful implementation of blockchain in financial reporting. Moreover, the literature highlights the importance of regulatory frameworks in shaping the adoption and effectiveness of blockchain technology. Regulatory support not only provides the necessary legal backing but also ensures that the technology is used responsibly and securely. The UAE's proactive stance on blockchain technology positions it well to leverage its benefits, but continuous efforts are needed to update and refine regulatory standards in response to evolving technological advancements. while blockchain technology holds significant promise for transforming financial reporting practices in the UAE, its successful implementation requires a multifaceted approach that addresses technological, regulatory, and organizational challenges. The hypotheses developed in this study provide a framework for investigating these impacts, offering insights that can guide policymakers, regulators, and industry practitioners in harnessing the potential of blockchain technology in financial reporting, this relationship are shown in *Figure (1)*. Thus, the following hypotheses can be proposed:

H1: Blockchain technology significantly enhances the accuracy of financial reporting in the UAE.

H2: Blockchain technology significantly improves the transparency of financial reporting practices in the UAE.

H3: The adoption of blockchain technology significantly reduces the risk of fraud in financial reporting in the UAE.
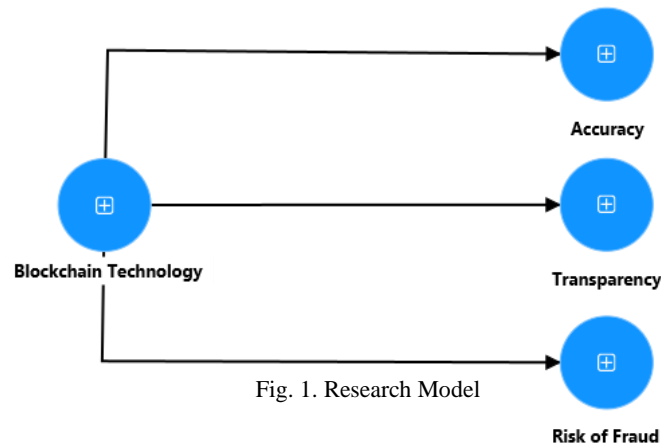

Fig. 1. Research Model

4. Methodology

The convenience sample was surveyed using a descriptive cross-sectional approach. As explained in the study community and the sampling unit, the researchers built and developed a special questionnaire that was distributed to the internal and external auditors who are involved in auditing financial statements of Industrial companies in the UAE. However, A five-point Likert scale, with 1 denoting the strongest agreement and 5 the largest disagreement, served as the basis for the questionnaire. Moreover, a survey was carried out to collect data for this study inside Jordanian commercial banks. In order to evaluate the study hypotheses, the acquired data was further analyzed using Smart PLS4 and the Statistical Package for Social Sciences (SPSS) version 29. These include doing descriptive analysis (such as calculating frequencies and percentages) on the study sample, evaluating the consistency of the study instrument's reliability using Cronbach's alpha, and running a basic linear regression analysis to look at the relationship between a continuous dependent variable and a single independent variable.

5. Findings

This paper computes the path coefficient to ascertain the degree of effect the independent variable has on the dependent variable. Moreover, we use the determination coefficient (R-Square) to measure the effect of the exogenous variable on the endogenous variable. With an R2value of 0.67 or higher, the endogenous latent variables in our structural model demonstrate a robust positive correlation with the exogenous variables. For a detailed perspective of the route coefficients inside the accomplishment motivation study paradigm, please refer to *Figure (2)* below.
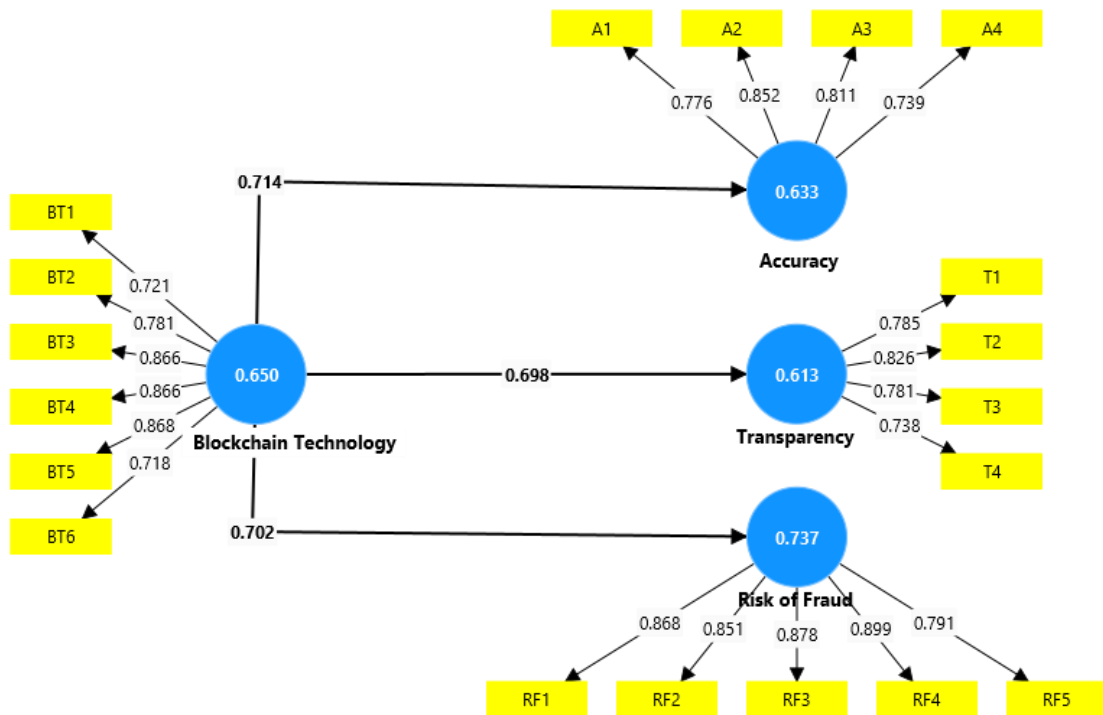

Figure 2. Measurement Model

In evaluating the impact of blockchain technology on financial reporting practices, it is essential to ensure that the constructs used in the research are reliable and valid. Reliability testing is a crucial step in this process, as it verifies the consistency and dependability of the measurement instruments. Table 1 presents the results of reliability testing for four key constructs: Accuracy, Blockchain Technology, Risk of

Fraud, and Transparency. The metrics used include Cronbach's alpha, Composite Reliability (rho_a and rho_c), and Average Variance Extracted (AVE). When evaluating research variables, a strong association between observable variables and their underlying constructs is indicated by the constant occurrence of outer loading values more than 0.70 for every indication. Even if a few indicators are somewhat below this cutoff, they are still within the range of 0.5 to 0.6 that Mulyono et al. (2020) established for convergent validity, which supports the strong correlation. Interestingly, no variable indicator shows an outer loading less than 0.50, confirming the validity and dependability of the selected indicators in evaluating the corresponding constructs. This highlights their potential for more thorough investigation in subsequent studies and confirms their applicability for research applications, guaranteeing the precise measurement and assessment of specified conceptions.

Table 1. Reliability Testing

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Accuracy	0.806	0.818	0.873	0.633
Blockchain Technology	0.890	0.897	0.917	0.650
Risk of Fraud	0.910	0.910	0.933	0.737
Transparency	0.790	0.800	0.864	0.613

Table 1 above presents the results of reliability testing for four constructs: Accuracy, Blockchain Technology, Risk of Fraud, and Transparency. The metrics used to assess reliability include Cronbach's alpha, Composite Reliability (rho_a and rho_c), and Average Variance Extracted (AVE). These metrics are critical for ensuring the consistency and validity of the constructs used in the study. However, Cronbach's alpha is a measure of internal consistency, indicating how closely related a set of items are as a group. A value above 0.70 is generally considered acceptable. In this table, Accuracy has a Cronbach's alpha of 0.806, indicating good internal consistency. Blockchain Technology has a very high Cronbach's alpha of 0.890, suggesting excellent internal consistency. Risk of Fraud shows a Cronbach's alpha of 0.910, which is also excellent and indicates that the items measuring this construct are highly consistent. Transparency has a Cronbach's alpha of 0.790, indicating good internal consistency, though it is slightly lower than the other constructs. Composite reliability (rho_a and rho_c) measures the overall reliability of a construct, taking into account the different loadings of each indicator. Values above 0.70 are considered satisfactory. Accuracy shows composite reliability values of 0.818 (rho_a) and 0.873 (rho_c), indicating high reliability. Blockchain Technology has values of 0.897 (rho_a) and 0.917 (rho_c), demonstrating excellent reliability. Risk of Fraud presents values of 0.910 (rho_a) and 0.933 (rho_c), indicating very high reliability. Transparency has values of 0.800 (rho_a) and 0.864 (rho_c), reflecting good reliability. The high composite reliability values across all constructs suggest that the items are well-suited to measure their respective constructs, with minimal measurement error.

AVE measures the amount of variance captured by a construct relative to the amount due to measurement error. Values above 0.50 are considered acceptable, indicating that more than half of the variance is captured by the construct. Accuracy has an AVE of 0.633, indicating that it captures a substantial amount of variance. Blockchain Technology has an AVE of 0.650, which is above the threshold and indicates good convergent validity. Risk of Fraud shows an AVE of 0.737, the highest among the constructs, indicating very strong convergent validity. Transparency has an AVE of 0.613, suggesting that it captures a sufficient amount of variance. The AVE values suggest that all constructs exhibit good convergent validity, meaning the items within each construct are well correlated and measure the intended concept. The reliability testing results in *Table 1* demonstrate that the constructs of Accuracy, Blockchain Technology, Risk of Fraud, and Transparency are reliable and valid measures for the study. The high values of Cronbach's alpha, composite reliability, and AVE indicate that the items within each construct are consistently measuring their intended concepts, with minimal measurement error. However, while the values are generally high, it is worth noting that Transparency has slightly lower reliability metrics compared to the other constructs. Although still within acceptable ranges, this suggests there might be room for improving

the measurement items or exploring additional items to enhance the construct's internal consistency. However, the reliability testing indicates strong support for the constructs used in the study, providing a solid foundation for further analysis and interpretation of the impact of blockchain technology on financial reporting practices in the UAE. In addition to reliability testing, it is crucial to assess the relationships between constructs to understand how blockchain technology impacts various aspects of financial reporting practices. *Table 2* provides the results of path analysis, which examines the direct effects of blockchain technology on Accuracy, Risk of Fraud, and Transparency. The table includes the original sample (O), sample mean (M), standard deviation (STDEV), T statistics, and P values for each relationship, offering insights into the strength and significance of these effects.

Table 2. Results of Hypothesis Testing

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Blockchain Technology -> Accuracy	0.714	0.716	0.033	21.847	0.000
Blockchain Technology -> Risk of Fraud	0.702	0.703	0.038	18.567	0.000
Blockchain Technology -> Transparency	0.698	0.700	0.038	18.564	0.000

Table 2 illustrates the direct effects of blockchain technology on three critical dimensions of financial reporting: Accuracy, Risk of Fraud, and Transparency. The path coefficients (original sample values) indicate the strength of these relationships, while the T statistics and P values demonstrate their statistical significance. However, for *(Blockchain Technology -> Accuracy)*, the path coefficient for the effect of blockchain technology on accuracy is 0.714, with a sample mean of 0.716 and a standard deviation of 0.033. This high coefficient suggests a strong positive relationship between blockchain technology and the accuracy of financial reporting. The T statistic of 21.847, which is significantly higher than the typical threshold of 1.96 for a 95% confidence level, indicates that this relationship is statistically significant. The P value of 0.000 further confirms the significance, suggesting that blockchain technology substantially enhances the accuracy of financial reporting. This aligns with previous findings that blockchain's immutable and verifiable nature reduces errors and ensures data integrity. While, (Blockchain Technology -> Risk of Fraud), the relationship between blockchain technology and the risk of fraud has a path coefficient of 0.702, a sample mean of 0.703, and a standard deviation of 0.038. This strong coefficient implies that blockchain technology significantly reduces the risk of fraud in financial reporting. The T statistic of 18.567, well above the critical value, indicates a highly significant relationship. The P value of 0.000 supports this conclusion, showing that the adoption of blockchain technology effectively mitigates fraud risks. This is consistent with literature suggesting that blockchain's transparent and tamper-proof nature deters fraudulent activities by providing a clear and unalterable audit trail. Lastly, (Blockchain Technology -> Transparency), for the impact on transparency, the path coefficient is 0.698, with a sample mean of 0.700 and a standard deviation of 0.038. This indicates a strong positive effect of blockchain technology on transparency in financial reporting. The T statistic of 18.564, significantly above the critical threshold, confirms the statistical significance of this relationship. The P value of 0.000 corroborates this finding, indicating that blockchain technology greatly enhances the transparency of financial practices. This is in line with studies that highlight blockchain's ability to provide real-time, verifiable access to financial data, thereby increasing transparency and stakeholder trust.

The path analysis results in *Table 2* clearly demonstrate the significant positive effects of blockchain technology on the accuracy, risk of fraud, and transparency of financial reporting practices in the UAE. The high path coefficients and significant T statistics and P values across all relationships underscore the transformative potential of blockchain technology in enhancing financial reporting. These findings suggest that blockchain not only improves the reliability and integrity of financial data but also promotes greater transparency and reduces the risk of fraudulent activities. Thus, the strong and statistically significant relationships highlighted in *Table 2* provide robust evidence supporting the adoption of blockchain technology in financial reporting. This reinforces the need for continued investment in blockchain infrastructure and training for financial professionals to fully realize these benefits in the UAE's financial

sector. In addition, to *Figure (3)* below could help to understand the relationships between variables and directs the development of well-founded conclusions backed by statistical validation.
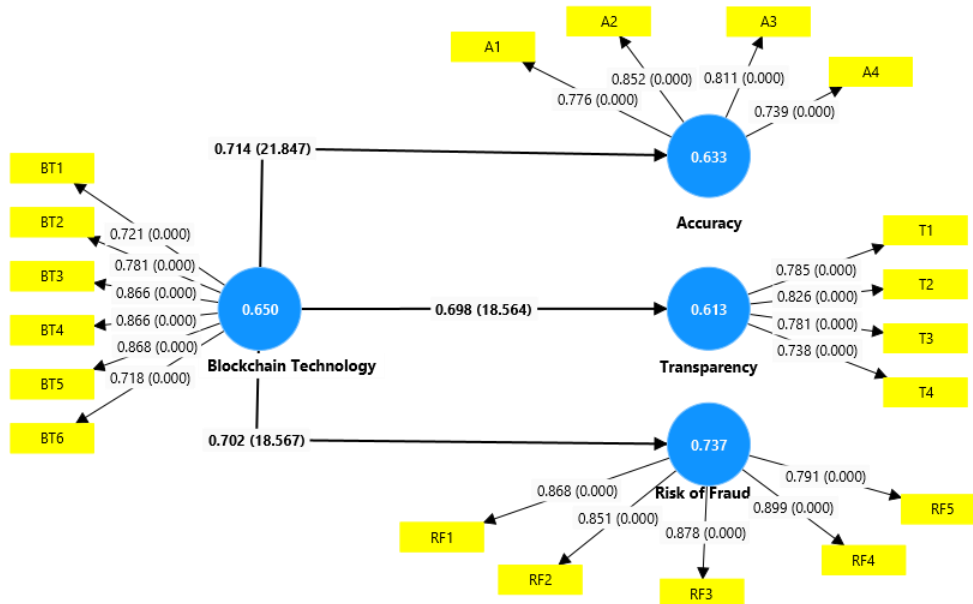

Figure 3. *Structural Model*

Based on *Figure (3)* above indicates a strong positive relationship between blockchain technology and the accuracy of financial reporting, with an original sample estimate (O) of 0.714. The T statistic of 21.847 and P value of 0.000 confirm this relationship is statistically significant. These results align with existing literature, highlighting blockchain's ability to provide an immutable and verifiable ledger, which reduces errors and ensures consistent, reliable financial data. The real-time data recording and verification processes of blockchain technology contribute to significantly enhanced accuracy in financial statements compared to traditional systems. In addition, the path analysis reveals a significant positive impact of blockchain technology on transparency, with an original sample estimate (O) of 0.698. Supported by a T statistic of 18.564 and a P value of 0.000, this relationship is statistically significant. Blockchain's transparent ledger allows authorized participants to access and verify transactions in real time, thereby increasing financial data transparency. This finding corroborates previous research, which underscores blockchain's potential to enhance transparency and accountability, making financial reporting more open and trustworthy. Lastly, the results demonstrate a strong and significant relationship between blockchain technology and fraud risk reduction, with an original sample estimate (O) of 0.702. The T statistic of 18.567 and P value of 0.000 confirm the statistical significance of this effect. Blockchain's tamper-proof nature and clear audit trails make financial record manipulation difficult, thereby reducing fraud risk. This finding is consistent with the literature, which highlights blockchain's effectiveness in preventing fraud through secure and transparent record-keeping.

The results provide compelling evidence that blockchain technology significantly enhances accuracy, transparency, and fraud resistance in financial reporting in the UAE. High path coefficients, T statistics, and significant P values across all hypotheses underscore blockchain's transformative potential in financial reporting. Organizations in the UAE should adopt blockchain technology to improve financial reporting processes, gaining increased accuracy, transparency, and security. Continued investment in blockchain infrastructure and training will be essential to fully realize these benefits. Based on analysis result, there is a strong positive relationship between blockchain technology and the accuracy of financial reporting, with an original sample estimate (O) of 0.714. The T statistic of 21.847 and P value of 0.000 confirm this relationship is statistically significant. These results align with existing literature, highlighting blockchain's ability to provide an immutable and verifiable ledger, which reduces errors and ensures consistent, reliable financial data. The real-time data recording and verification processes of blockchain technology contribute to significantly enhanced accuracy in financial statements compared to traditional systems (Abdennadher et

al., 2022; Parmoodeh et al., 2023; Ahmad et al., 2022; Ahmed et al., 2023). In addition, the path analysis reveals a significant positive impact of blockchain technology on transparency, with an original sample estimate (O) of 0.698. Supported by a T statistic of 18.564 and a P value of 0.000, this relationship is statistically significant. Blockchain's transparent ledger allows authorized participants to access and verify transactions in real-time, thereby increasing financial data transparency. This finding corroborates previous research, which underscores blockchain's potential to enhance transparency and accountability, making financial reporting more open and trustworthy (Abdennadher et al., 2022; Petratos et al., 2020). Lastly, the results demonstrate a strong and significant relationship between blockchain technology and fraud risk reduction, with an original sample estimate (O) of 0.702. The T statistic of 18.567 and P value of 0.000 confirm the statistical significance of this effect. Blockchain's tamper-proof nature and clear audit trails make financial record manipulation difficult, thereby reducing fraud risk. This finding is consistent with the literature, which highlights blockchain's effectiveness in preventing fraud through secure and transparent record-keeping (Mahtani, 2022; Abdulla et al., 2022). However, the interpretation of these results supports the conclusions of previous studies, indicating that blockchain technology significantly enhances the accuracy, transparency, and fraud resistance of financial reporting in the UAE. These findings suggest that adopting blockchain technology can provide substantial benefits in improving financial reporting practices.

6. Implication

The findings of this study provide significant implications for both practical and theoretical realms. Practically, the results underscore the transformative potential of blockchain technology in enhancing the accuracy, transparency, and security of financial reporting in the UAE. For practitioners, including accountants, auditors, and financial managers, the adoption of blockchain technology can lead to more reliable and efficient financial reporting processes. By leveraging blockchain's immutable and verifiable ledger, organizations can reduce errors, increase transparency, and mitigate the risk of fraud. This can foster greater trust among stakeholders, improve regulatory compliance, and enhance overall corporate governance. Theoretically, this study contributes to the existing body of knowledge by empirically validating the positive impact of blockchain technology on financial reporting. The strong positive relationships identified between blockchain technology and key financial reporting attributes (accuracy, transparency, and fraud reduction) provide a robust foundation for future research. This study also highlights the need for further exploration into the mechanisms through which blockchain technology can be integrated into existing financial reporting frameworks. Additionally, it opens avenues for examining the broader implications of blockchain technology on financial markets and regulatory practices.

7. Conclusion

This study concludes that blockchain technology significantly enhances the accuracy, transparency, and fraud resistance of financial reporting practices in the UAE. The empirical evidence provided by the path analysis shows that blockchain's immutable ledger, real-time verification, and tamper-proof nature contribute substantially to these improvements. These findings align with previous research and reinforce the potential benefits of blockchain adoption in the financial sector. However, this study has several limitations. The sample size and scope were confined to the UAE, which may limit the generalizability of the findings to other regions or contexts. Additionally, the rapid evolution of blockchain technology means that ongoing developments could impact its applicability and effectiveness in financial reporting. Future research should aim to expand the sample size and geographic scope to validate these findings further. Moreover, longitudinal studies could provide deeper insights into the long-term effects of blockchain adoption on financial reporting practices. In conclusion, this study highlights the significant positive impact of blockchain technology on financial reporting in the UAE. It provides valuable insights for practitioners and adds to the theoretical understanding of blockchain's role in enhancing financial reporting. Continued exploration and adaptation of blockchain technology will be crucial for realizing its full potential and addressing the evolving challenges in financial reporting and corporate governance.

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The Role of Financial Technology (Fintech) in Promoting Financial Inclusion A Literature Review

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A B S T R A C T

This literature review aims to examine the role of Financial Technology (Fintech) in promoting financial inclusion. As access to financial services remains a critical issue globally, particularly in underserved and marginalized communities, understanding how Fintech can contribute to expanding financial inclusion is imperative. The aim is to analyze existing literature to identify the mechanisms through which Fintech initiatives promote financial inclusion, as well as the challenges and opportunities associated with their implementation. Employing a systematic literature review approach, this research synthesizes findings from a wide range of academic papers, reports, and case studies related to Fintech and financial inclusion. The review encompasses studies that explore various aspects of Fintech, including mobile banking, peer-to-peer lending, digital payments, and microfinance, in the context of promoting financial inclusion. The literature review reveals that Fintech plays a significant role in promoting financial inclusion by overcoming traditional barriers to access, such as geographical distance, high transaction costs, and lack of formal identification. Fintech innovations enable the provision of affordable and accessible financial services to underserved populations, thereby fostering financial empowerment and economic development. However, the review also identifies challenges related to regulatory frameworks, cybersecurity risks, and digital literacy, which must be addressed to maximize the impact of Fintech on financial inclusion. The findings offer valuable insights for policymakers, financial institutions, and Fintech providers seeking to leverage technology to advance financial inclusion objectives.

1. Introduction

In recent years, Financial Technology (Fintech) has emerged as a pivotal force driving innovation within the financial sector. The convergence of finance and technology has not only revolutionized traditional banking and financial operations but also significantly contributed to promoting financial inclusion. Financial inclusion refers to the process of ensuring that individuals and businesses, irrespective of their socio-economic status, have access to essential financial products and services that meet their needs, such as transactions, payments, savings, credit, and insurance, delivered in a responsible and sustainable manner. This literature review aims to examine the role of Fintech in promoting financial inclusion, exploring the extent to which innovative financial services are reaching underserved populations and the impact of these services on their economic well-being.

The motivation for this study stems from the growing recognition of Fintech's potential to address the persistent issue of financial exclusion. In many parts of the world, particularly in developing countries, a significant portion of the population remains unbanked or underbanked, lacking access to formal financial services. Traditional banking infrastructure often fails to reach remote and low-income communities due to high operational costs and logistical challenges. Fintech, with its ability to leverage digital platforms and mobile technologies, offers a promising solution to bridge this gap. Understanding how Fintech can effectively promote financial inclusion is crucial for policymakers, financial institutions, and development organizations striving to create inclusive financial systems. Despite the promising potential of Fintech to enhance financial inclusion, several challenges hinder its widespread adoption and effectiveness. These challenges include regulatory barriers, digital literacy issues, cybersecurity concerns, and the digital divide that limits access to technology in certain regions. Moreover, there is a lack of comprehensive understanding regarding the impact of different Fintech solutions on various demographic groups. While numerous studies have explored the general benefits of Fintech, there is a need for a more focused analysis on how specific Fintech innovations are addressing the unique needs of underserved populations and what factors contribute to their success or failure. However, existing literature on Fintech and financial inclusion is extensive but fragmented, with studies often focusing on particular aspects of the phenomenon without providing a holistic view. There is a noticeable gap in the literature regarding a systematic review that consolidates findings across different regions, technologies, and population groups. Additionally, there is limited research on the long-term impact of Fintech solutions on financial inclusion and economic empowerment. This literature review seeks to fill this gap by synthesizing existing research, identifying key trends and challenges, and highlighting areas that require further investigation. By doing so, it aims to provide a comprehensive understanding of the role of Fintech in promoting financial inclusion and offer insights for future research and policy development.

Fintech encompasses a wide range of applications, including mobile banking, peer-to-peer lending, blockchain technology, and digital payments, all of which contribute to making financial services more accessible, efficient, and user-friendly. By leveraging innovative technologies, Fintech companies are able to reduce operational costs, streamline processes, and provide services to underserved and unbanked populations, thus bridging the gap between financial institutions and consumers who previously had limited or no access to financial services. However, this literature review aims to explore the role of Fintech in promoting financial inclusion by examining existing research and case studies. It will provide an overview of the key Fintech innovations that have facilitated financial inclusion, discuss the impact of these innovations on different segments of the population, and identify the challenges and opportunities associated with the widespread adoption of Fintech solutions. By synthesizing the current body of knowledge, this review seeks to offer insights into the potential of Fintech to create a more inclusive financial ecosystem and highlight areas for future research and policy development. This research aims to investigate the role of Fintech in transforming traditional financial services, focusing on its impact on efficiency, accessibility, and user experience. Fintech has introduced various platforms and applications that enable individuals and companies to access, transact, and manage their finances more quickly and effectively (Jarvi, 2021). By exploring these significant changes, this research hopes to provide insights for the financial industry, government, and academics to face the challenges and opportunities arising from these dynamic changes. Additionally, it is hoped that the findings of this research can serve as a basis for developing policies and business strategies that are responsive to changes in the financial services ecosystem.

Despite the substantial advancements in understanding the role of Financial Technology (Fintech) in promoting financial inclusion, several research gaps persist. While existing studies highlight the positive impact of Fintech on financial inclusion, there is a lack of comprehensive, cross-regional analyses that compare the effects of Fintech across different developing and emerging markets. Furthermore, most research relies on cross-sectional data, lacking longitudinal studies that examine the long-term impacts of Fintech innovations on financial inclusion. Detailed investigations into the specific mechanisms through which Fintech innovations, such as blockchain and AI-driven services, enhance financial inclusion are also limited. Additionally, there is insufficient exploration of the regulatory and policy frameworks that best support Fintech adoption while ensuring consumer protection and financial stability. Research on the inclusivity of Fintech services, particularly how these services can be designed to benefit marginalized and

underserved populations, is needed. Lastly, the intersection of Fintech, financial inclusion, and environmental sustainability remains underexplored, highlighting a critical area for future research.

2. Literature Review

Financial Technology (Fintech) has emerged as a significant force in transforming the financial industry by leveraging technological innovations to enhance and automate financial services. Fintech includes a wide array of products and services such as mobile banking, digital payments, peer-to-peer lending, blockchain technology, and artificial intelligence (AI). These innovations aim to improve efficiency, accessibility, and convenience, making financial services more user-friendly and widely available (Gomber et al., 2018). A crucial aspect of Fintech is its potential to promote financial inclusion by providing access to affordable financial services for underserved or unbanked populations, thus fostering economic development and reducing poverty (Arner et al., 2018). Digital banking applications have revolutionized the financial sector by enabling users to conduct transactions, access financial information, and manage accounts through electronic platforms, particularly benefiting regions lacking traditional banking infrastructure (Gomber et al., 2018). Additionally, Fintech has transformed payment systems through electronic platforms such as digital wallets, payment applications, and online gateways, facilitating cashless transactions (Golubev & Ryabov, 2020). Peer-to-peer lending and crowdfunding are significant Fintech innovations that provide alternative financing sources, offering vital funding opportunities for individuals and small businesses that traditional financial intermediaries might overlook (Taherdoost, 2023). Blockchain technology, underpinning cryptocurrencies, offers decentralized and secure transaction methods, enhancing financial inclusivity by reducing costs and improving trust, especially in regions with weak financial infrastructure (Arner et al., 2018). Moreover, AI and data analytics in Fintech enable sophisticated data analysis, personalized financial recommendations, improved risk management, and fraud detection, thus tailoring financial products to meet specific consumer needs (Everything, 2018).

For consumers, Fintech solutions provide easier access to financial services, greater convenience, and often lower costs. Mobile banking and digital wallets allow financial transactions anytime and anywhere, benefiting individuals in remote or underserved areas (Gomber et al., 2018). For financial institutions, Fintech offers improved operational efficiency, cost reduction, and customer base expansion, with AI-driven automation enhancing service delivery and customer satisfaction (Saksonova, 2017). Governments and regulators play a crucial role in fostering a supportive environment for Fintech innovation, balancing the encouragement of innovation with consumer protection and financial stability (Boratyńska, 2019). However, Fintech also presents challenges such as cybersecurity threats, data privacy concerns, and the risk of financial exclusion due to digital divides. Addressing these challenges and ensuring Fintech services are accessible to all, including those with limited digital literacy or technology access, is essential for achieving inclusive growth (Weichert, 2017). Overall, Fintech holds significant potential for promoting financial inclusion by providing innovative and accessible financial services, but it is crucial to address the associated challenges to ensure these solutions are inclusive and secure.

The literature on the role of Financial Technology (Fintech) in promoting financial inclusion is extensive and varied, reflecting the diverse applications and impacts of these technological innovations. Fintech, encompassing innovations such as mobile banking, digital payments, peer-to-peer lending, blockchain technology, and artificial intelligence (AI), has significantly transformed the financial industry. These technologies aim to enhance efficiency, accessibility, and convenience, making financial services more user-friendly and widely available (Gomber et al., 2018). Fintech plays a crucial role in promoting financial inclusion by providing access to affordable financial services for underserved or unbanked populations, thereby fostering economic development and reducing poverty (Arner et al., 2018). Digital banking applications, for instance, have revolutionized the financial sector by enabling users to conduct transactions, access financial information, and manage accounts through electronic platforms. This is particularly beneficial in regions lacking traditional banking infrastructure (Gomber et al., 2018). Similarly, electronic payment platforms, including digital wallets, payment applications, and online gateways, facilitate cashless transactions, making financial operations more convenient and accessible (Golubev & Ryabov, 2020). Peer-to-peer lending and crowdfunding are significant Fintech innovations that provide alternative financing

sources. These platforms offer vital funding opportunities for individuals and small businesses that might be overlooked by traditional financial intermediaries (Taherdoost, 2023). Blockchain technology, which underpins cryptocurrencies, offers decentralized and secure transaction methods, enhancing financial inclusivity by reducing costs and improving trust, especially in regions with weak financial infrastructure (Arner et al., 2018). Furthermore, AI and data analytics in Fintech enable sophisticated data analysis, personalized financial recommendations, improved risk management, and fraud detection, tailoring financial products to meet specific consumer needs (Everything, 2018). For consumers, Fintech solutions provide easier access to financial services, greater convenience, and often lower costs. Mobile banking and digital wallets, for example, allow financial transactions to be conducted anytime and anywhere, benefiting individuals in remote or underserved areas (Gomber et al., 2018). For financial institutions, Fintech offers opportunities to improve operational efficiency, reduce costs, and expand their customer base. Automation driven by AI enhances service delivery and customer satisfaction (Saksonova, 2017). Governments and regulators play a crucial role in fostering a supportive environment for Fintech innovation, balancing the encouragement of innovation with consumer protection and financial stability (Boratyńska, 2019).

Despite its benefits, Fintech presents challenges such as cybersecurity threats, data privacy concerns, and the risk of financial exclusion due to digital divides. Addressing these challenges and ensuring that Fintech services are accessible to all, including those with limited digital literacy or technology access, is essential for achieving inclusive growth (Weichert, 2017). Jha and Dangwal (2024) highlight the importance of understanding the behavioral patterns associated with lending, investment, and market provision-related Fintech services. They suggest that further research is needed to explore the relationship between Fintech services and the usage and quality dimensions of financial inclusion, particularly in low-middle-income (LMIGN) and upper-middle-income (UMIGN) countries. Additionally, they call for future studies to examine the role of Fintech and financial inclusion in the development of LMIGN, providing valuable insights and guiding future research directions by comprehensively mapping existing studies.

The literature on the role of Financial Technology (Fintech) in promoting financial inclusion reveals diverse perspectives on the impact of these technological innovations. Sant'Anna and Figueiredo (2024) explore whether Fintech innovation is beneficial or detrimental to financial inclusion and financial stability through a systematic literature review. Their work highlights the dual-edged nature of Fintech, where the same technologies that enhance access to financial services can also introduce new risks and instabilities in the financial system. This underscores the need for a balanced approach in harnessing Fintech for inclusive growth while mitigating associated risks. In addition, Ediagbonya and Tioluwani (2023) focus on the role of Fintech in driving financial inclusion in developing and emerging markets. They identify key issues, challenges, and prospects, noting that while Fintech offers significant opportunities for expanding financial access, it also faces hurdles such as regulatory constraints, digital literacy gaps, and infrastructural deficiencies. Their study emphasizes the importance of tailored regulatory frameworks and capacity-building initiatives to support Fintech adoption in these regions. Rauniyar et al. (2021) discuss the role of Fintech innovations in enhancing digital financial inclusion. They highlight how innovations such as mobile money, digital lending platforms, and blockchain technology are bridging the gap for unbanked populations by offering convenient, cost-effective, and secure financial solutions. Their findings suggest that these innovations are crucial for integrating marginalized groups into the financial system, thereby promoting economic inclusion and reducing poverty.

Suryono et al. (2020) provide a systematic literature review of the challenges and trends in Fintech, identifying several key barriers to its widespread adoption, including cybersecurity threats, regulatory uncertainty, and the digital divide. Their work underscores the need for robust cybersecurity measures, clear regulatory guidelines, and initiatives to improve digital literacy to maximize the benefits of Fintech. Cosma and Rimo (2023) examine the social implications of Fintech, particularly its role in addressing financial inclusion and social inequality. They argue that while Fintech can play a significant role in reducing social inequality by providing wider access to financial services, it can also exacerbate existing disparities if not implemented inclusively. Their study calls for a holistic approach that considers both technological and social dimensions to ensure that Fintech contributes positively to societal challenges.

Kurniasari et al. (2021) investigate the role of Fintech in increasing financial inclusion in Indonesia. Their research highlights how Fintech solutions such as digital wallets, peer-to-peer lending, and online banking

are transforming the financial landscape in Indonesia by making financial services more accessible to a broader population. They stress the importance of supportive government policies and collaborations between Fintech firms and traditional financial institutions to drive inclusive financial growth. Jha and Dangwal (2024) conduct a systematic literature review highlighting how Fintech services enhance financial inclusion in developing countries. Their study emphasizes the transformative potential of Fintech in breaking down traditional barriers to financial access and providing inclusive financial solutions. In addition, Harsono and Suprapti (2024) examine the role of Fintech in transforming traditional financial services. They highlight how Fintech innovations are revolutionizing the financial industry by automating processes, reducing operational costs, and improving service quality. Their study illustrates the significant impact of Fintech on the efficiency and accessibility of financial services.

Ololade (2024) offers a comparative analysis of Fintech innovations and financial inclusion initiatives in Africa and the United States. This study highlights the contextual differences and unique challenges faced by each region, providing insights into the strategies that can be employed to enhance financial inclusion through Fintech. The comparative approach underscores the need for region-specific policies and frameworks to maximize the impact of Fintech on financial inclusion. Afjal (2023) provides a bibliometric analysis on the role of digital financial services within Fintech in enhancing financial inclusion and economic development. He identifies key trends and research areas, emphasizing the critical role of digital financial services in bridging the financial divide and promoting economic growth. His analysis highlights the interconnectedness of financial inclusion and economic development facilitated by Fintech innovations. Noreen et al. (2022) investigate the role of government policies in the adoption of Fintech and financial inclusion in Pakistan. They highlight how supportive government policies can facilitate the widespread adoption of Fintech, thereby enhancing financial inclusion. Their study underscores the importance of a conducive regulatory environment in promoting Fintech innovations and ensuring their successful implementation.

The literature on the role of Financial Technology (Fintech) in promoting financial inclusion reveals a diverse array of perspectives and insights, particularly regarding its impact on rural and developing economies. Goswami, Sharma, and Chouhan (2022) investigate the impact of Fintech on financial inclusion in rural India, highlighting how digital financial services have significantly expanded access to financial products for underserved populations. Their findings underscore the potential of Fintech to bridge the financial divide in rural areas by providing convenient and cost-effective financial solutions. Giglio (2021) provides a comprehensive literature review on Fintech, emphasizing its transformative impact on the financial sector. The review covers various Fintech innovations and their implications for financial inclusion, illustrating how these technologies can democratize access to financial services and improve financial literacy among diverse demographic groups. Telukdarie and Mungar (2023) explore the impact of digital financial technology on accelerating financial inclusion in developing economies. Their study highlights the role of digital platforms in facilitating financial transactions, reducing costs, and enhancing the efficiency of financial services. They argue that digital financial technologies are crucial for integrating unbanked populations into the formal financial system.

Coffie and Hongjiang (2023) examine the development of the Fintech market and its role in promoting financial inclusion in Ghana. They emphasize the importance of heterogeneous actors, including governments, financial institutions, and technology providers, in driving Fintech adoption. Their research indicates that collaborative efforts are essential for overcoming barriers to financial inclusion and ensuring the widespread availability of Fintech services. Kulshrestha (2023) examines the role of Fintech in enhancing financial literacy and inclusion among low-income households in India. The study demonstrates how Fintech solutions can provide educational tools and resources that improve financial literacy, thereby enabling low-income households to make informed financial decisions and access financial services. Danladi et al. (2023) explore collaborative approaches to Fintech adoption in developing economies to attain Sustainable Development Goals (SDGs) through financial inclusion. Their research underscores the importance of partnerships between governments, private sector, and non-governmental organizations in driving Fintech adoption and achieving inclusive growth.

The role of Financial Technology (Fintech) in promoting financial inclusion is increasingly being recognized across various regions and contexts. Kumar and Rani (2022) provide a comprehensive review of

the Fintech landscape, identifying key trends and setting a future research agenda that emphasizes the need for further exploration of Fintech's impact on financial inclusion. Their systematic literature review underscores the transformative potential of Fintech in reshaping financial services and expanding access to unbanked and underbanked populations. Aloulou et al. (2024) investigate whether Fintech adoption increases the diffusion rate of digital financial inclusion within the banking industry. Their study demonstrates that Fintech adoption significantly enhances the accessibility and usage of digital financial services, leading to higher rates of financial inclusion. This finding is crucial for policymakers and financial institutions aiming to leverage technology to broaden financial access. Moreover, Rehman et al. (2024) explore the mediating role of digital marketing in the relationship between Fintech and financial inclusion. They argue that effective digital marketing strategies can enhance consumer awareness and acceptance of Fintech solutions, thereby boosting financial inclusion. Their research highlights the importance of behavioral intention in the adoption of Fintech services, suggesting that targeted marketing efforts are essential for maximizing Fintech's impact. Chinoda and Mashamba (2021) examine the nexus between Fintech, financial inclusion, and income inequality in Africa. They find that while Fintech significantly promotes financial inclusion, its impact on income inequality is complex and multifaceted. Their study suggests that while Fintech can reduce income disparities by providing financial services to marginalized groups, it can also inadvertently exacerbate inequality if not implemented inclusively. Arner et al. (2020) discuss the interplay between sustainability, Fintech, and financial inclusion. They highlight that sustainable Fintech solutions can promote financial inclusion while also addressing broader environmental and social goals. Their research emphasizes the need for an integrated approach that considers sustainability in the design and deployment of Fintech innovations.

The role of Financial Technology (Fintech) in driving financial inclusion in developing and emerging markets is a multifaceted subject that addresses numerous issues, challenges, and prospects. Ediagbonya and Tioluwani (2023) delve into the factors that promote or impede the role of Fintech in financial inclusion, specifically focusing on Nigeria. Their research highlights the significant impact of regulatory frameworks, digital literacy, and infrastructure on the adoption and effectiveness of Fintech solutions in promoting financial inclusion. They stress that while Fintech holds promise for expanding access to financial services, there are substantial barriers that need to be addressed to realize its full potential. Cosma and Rimo (2023) examine the interaction between Fintech, financial inclusion, and social inequality. They argue that while Fintech can be a powerful tool for promoting financial inclusion, it also has the potential to exacerbate social inequalities if not implemented inclusively. Their analysis underscores the need for inclusive Fintech strategies that consider the socio-economic context to ensure that technological advancements benefit all segments of society. Joia and Cordeiro (2021) employ a Delphi-based approach to investigate how Fintech can impact financial inclusion in Brazil. Their findings indicate that Fintech has significant potential to enhance financial inclusion by providing more accessible financial services. However, they also highlight the importance of addressing challenges such as regulatory constraints and the need for a supportive ecosystem to foster Fintech growth.

Danladi et al. (2023) explore collaborative approaches to Fintech adoption in developing economies to attain Sustainable Development Goals (SDGs) through financial inclusion. Their study emphasizes the importance of partnerships between various stakeholders, including governments, private sector, and non-governmental organizations, to enhance the adoption and impact of Fintech in promoting financial inclusion. They argue that collaborative efforts are crucial for overcoming the barriers to financial inclusion and achieving sustainable development. Mittal et al. (2024) discuss Fintech's transformative influence on traditional banking strategies and its role in enhancing financial inclusion in India. They highlight how Fintech innovations are altering traditional banking tactics, making financial services more accessible and inclusive. Their study illustrates the synergy between Fintech and traditional banking institutions in expanding financial access to underserved populations. Benjamin et al. (2024) focus on the role of personalization in Fintech marketing and customer communication in enhancing financial inclusion. They argue that effective marketing and communication strategies are key drivers of financial inclusion, as they help build consumer trust and awareness of Fintech services. Their research highlights the importance of personalized financial products and services in meeting the diverse needs of consumers. Ololade (2024) provides a comparative analysis of Fintech innovations and financial inclusion initiatives in Africa and the

United States. This study highlights the different approaches and outcomes in these regions, providing insights into the strategies that can be employed to enhance financial inclusion through Fintech. The comparative analysis underscores the importance of context-specific policies and frameworks to maximize the impact of Fintech on financial inclusion. Sabilla (2023) examines the role of peer-to-peer (P2P) lending in Fintech towards financial inclusion in Indonesia. Her research shows that P2P lending platforms have played a significant role in increasing financial inclusion by providing alternative financing options to individuals and small businesses that are underserved by traditional financial institutions. The study emphasizes the need for regulatory support and consumer protection measures to ensure the sustainable growth of P2P lending. Ali and Abdullah (2020) conduct an exploratory study on Fintech and financial inclusion in Pakistan. They find that Islamic finance principles can complement Fintech solutions to enhance financial inclusion. Their research provides insights into how cultural and religious factors can influence the adoption and effectiveness of Fintech services. Kshetri (2021) explores the role of artificial intelligence (AI) in promoting financial inclusion in developing countries. He argues that AI can significantly enhance financial inclusion by providing tailored financial products, improving risk assessment, and reducing operational costs. His study highlights the potential of AI-driven Fintech solutions to address the unique challenges faced by developing economies.

Mehrotra (2019) discusses the challenges of maintaining a focus on financial inclusion amidst the rapid growth of Fintech. He argues that while Fintech holds great promise for enhancing financial inclusion, there is a risk of losing sight of this goal if commercial interests overshadow social objectives. This study calls for a balanced approach that prioritizes both innovation and inclusivity. Liu et al. (2022) explore the intersection of green financing, Fintech, and financial inclusion, examining their combined impact on energy efficiency. Their research indicates that integrating Fintech with green financing initiatives can promote sustainable development and enhance financial inclusion by providing accessible and environmentally friendly financial solutions. Hollanders (2020) identifies the opportunities and challenges associated with Fintech and financial inclusion. The study highlights the potential of Fintech to provide inclusive financial services but also warns of the risks related to cybersecurity, data privacy, and the digital divide. Addressing these challenges is crucial for ensuring that Fintech can effectively promote financial inclusion.

Demir et al. (2022) investigate the relationship between Fintech, financial inclusion, and income inequality using a quantile regression approach. Their findings suggest that while Fintech can enhance financial inclusion, its impact on income inequality varies across different income levels. This study highlights the need for targeted policies to ensure that Fintech benefits all segments of society. Fernández-Olit et al. (2020) provide a systematized literature review on financial inclusion and exclusion in developed countries. They highlight the persistent barriers to financial inclusion in these regions and discuss the potential of Fintech to address these challenges by offering innovative and accessible financial solutions. Senyo and Osabutey (2020) delve into the antecedents of financial inclusion through Fintech innovations. They identify critical factors such as technological infrastructure, regulatory frameworks, and consumer trust that influence the adoption and effectiveness of Fintech solutions. Their research provides valuable insights into the conditions necessary for Fintech to thrive and promote financial inclusion. Makina (2019) explores the potential of Fintech in enabling financial inclusion across Africa. He argues that Fintech innovations such as mobile money and digital banking platforms have significantly expanded financial access to previously unbanked populations. This expansion not only fosters economic growth but also reduces poverty by integrating more people into the financial system. Kandpal and Mehrotra (2019) focus on the role of Fintech and digital financial services in promoting financial inclusion in India. They discuss how digital financial services, including mobile banking and online payment systems, have made financial services more accessible to the rural and urban poor. This accessibility is crucial for bridging the financial divide and fostering inclusive economic development. Loo (2019) identifies the best growth markets for Fintech within ASEAN, emphasizing the role of Fintech in enhancing financial inclusion in the region. He highlights that countries with supportive regulatory environments and high levels of digital literacy are best positioned to benefit from Fintech innovations. Tam and Hanh (2018) focus on the role of Fintech in promoting financial inclusion in Vietnam. They provide empirical findings and policy implications, demonstrating that Fintech can significantly enhance financial access in developing countries. Their study underscores the importance of supportive regulatory frameworks and tailored policy interventions to facilitate the adoption of Fintech.

Salampasis and Mention (2018) discuss the potential of Fintech to harness innovation for financial inclusion. They argue that blockchain and other digital finance technologies can provide secure, transparent, and accessible financial services, particularly in regions with limited financial infrastructure.

3. Methodology

The literature review aims to synthesize existing research on the role of Financial Technology (Fintech) in promoting financial inclusion in developing and emerging markets. A systematic approach was adopted to collect, evaluate, and synthesize relevant literature. The search strategy involved comprehensive searches in academic databases such as Google Scholar, JSTOR, ScienceDirect, IEEE Xplore, and PubMed, as well as industry reports from the World Bank, International Monetary Fund (IMF), and Financial Stability Board (FSB), and institutional publications from Fintech companies, financial institutions, and regulatory bodies. Keywords and search terms like "Financial Technology," "Fintech," "Financial Inclusion," "Developing Markets," "Emerging Economies," "Digital Financial Services," "Mobile Banking," "Peer-to-Peer Lending," "Blockchain," and "Digital Payments" were used, employing Boolean operators (AND, OR) to refine the search results.

Inclusion criteria were set to ensure relevance, focusing on studies that addressed the role of Fintech in promoting financial inclusion in developing and emerging markets, published within the last ten years, and available in English. Exclusion criteria included studies that were not directly related to Fintech or financial inclusion, those conducted in developed markets without significant relevance to developing or emerging markets, and non-peer-reviewed articles such as editorials and opinion pieces. In addition, data extraction involved a standardized form capturing author(s), year of publication, title, objectives, methodology, key findings, and implications for financial inclusion. A thematic analysis approach was used to synthesize the data, identifying key themes such as the impact of Fintech on financial inclusion, barriers to Fintech adoption, regional variations, policy and regulatory frameworks, and future directions. The quality of the included studies was assessed based on methodological rigor, relevance, and contribution to knowledge. The findings from the literature review were systematically reported and presented, structured to provide a clear and coherent synthesis of existing research. This review approach aims to contribute valuable insights and inform future research, policy, and practice in the area of Fintech and financial inclusion.

4. Findings

Despite significant advancements in understanding the role of Financial Technology (Fintech) in promoting financial inclusion, several gaps remain in the existing literature. Addressing these gaps is crucial for a more comprehensive understanding of Fintech's impact and for developing strategies to maximize its benefits. Much of the existing research focuses on specific regions or countries, leading to a fragmented understanding of Fintech's role in financial inclusion across different geographical and socio-economic contexts. For instance, while studies by Ediagbonya and Tioluwani (2023) and Joia and Cordeiro (2021) provide insights into Fintech's impact in Nigeria and Brazil, respectively, there is limited comparative research that examines how Fintech influences financial inclusion across various developing and emerging markets. A more nuanced, cross-regional analysis is needed to understand the diverse factors that affect Fintech adoption and its outcomes in different contexts. Most existing studies, such as those by Aloulou et al. (2024) and Rehman et al. (2024), use cross-sectional data to assess Fintech's impact on financial inclusion. While these studies provide valuable snapshots, there is a lack of longitudinal research that tracks the long-term effects of Fintech adoption on financial inclusion. Longitudinal studies are essential to understand the sustained impact of Fintech innovations, the evolution of user behavior, and the dynamic interaction between Fintech services and regulatory changes over time. While numerous studies, including those by Chinoda and Mashamba (2021) and Cosma and Rimo (2023), highlight the positive impact of Fintech on financial inclusion, there is limited exploration of the detailed mechanisms through which Fintech achieves these outcomes. Specifically, there is a need for deeper investigation into how different Fintech innovations, such as blockchain, peer-to-peer lending, and AI-driven services, contribute to various dimensions of financial inclusion, such as access, usage, and quality of financial services.

The role of regulatory frameworks and government policies in facilitating or hindering Fintech adoption is highlighted by studies like those of Tam and Hanh (2018) and Ali and Abdullah (2020). However, there is insufficient research on the optimal regulatory and policy conditions that balance innovation with consumer protection and financial stability. More empirical research is needed to identify best practices and effective regulatory strategies that can be adopted across different regions to support Fintech-driven financial inclusion. Moreover, Cosma and Rimo (2023); Chinoda and Mashamba (2021) points out that while Fintech has the potential to promote financial inclusion, it can also exacerbate social inequalities if not implemented inclusively. There is a need for more focused research on the inclusivity of Fintech services, particularly on how these services can be designed and deployed to benefit marginalized and underserved populations. This includes examining the socio-economic barriers that prevent certain groups from accessing Fintech services and developing strategies to overcome these challenges. In addition, the role of behavioral and psychological factors in Fintech adoption and financial inclusion is an emerging area that requires further exploration. Studies like those by Rehman et al. (2024) highlight the importance of digital marketing and consumer awareness, but there is limited research on the broader behavioral and psychological determinants of Fintech adoption. Understanding these factors is crucial for designing user-centric Fintech solutions that effectively meet the needs of diverse user groups. Furthermore, Arner et al. (2020) discuss the potential of sustainable Fintech solutions, but there is a paucity of research on the intersection of Fintech, financial inclusion, and environmental sustainability. Investigating how Fintech can contribute to sustainable development goals (SDGs) while promoting financial inclusion is an important research gap that needs to be addressed. In conclusion, while the existing literature provides a solid foundation for understanding the role of Fintech in promoting financial inclusion, addressing these research gaps is essential for a more comprehensive and nuanced understanding. Future research should focus on cross-regional comparisons, longitudinal studies, detailed mechanisms of impact, regulatory environments, inclusivity, behavioral factors, and sustainability to fully realize the potential of Fintech in enhancing financial inclusion.

The literature review reveals that Fintech plays a significant role in promoting financial inclusion by overcoming traditional barriers such as geographical distance, high transaction costs, and the lack of formal identification. Fintech innovations, including mobile banking, peer-to-peer lending, digital payments, and microfinance, provide affordable and accessible financial services to underserved populations. These services foster financial empowerment and economic development by enabling individuals to participate in the financial system, save money, access credit, and make transactions. However, the review also identifies challenges that must be addressed to maximize the impact of Fintech on financial inclusion. These challenges include regulatory barriers, cybersecurity risks, and digital literacy issues. Effective regulatory frameworks are needed to balance innovation with consumer protection, while cybersecurity measures are essential to safeguard user data and build trust in Fintech services. Additionally, improving digital literacy is crucial to ensure that all individuals can effectively use Fintech solutions.

5. Implication

The findings of this literature review have several important implications for policymakers, financial institutions, and Fintech providers. Policymakers need to develop and implement regulatory frameworks that support Fintech innovation while ensuring consumer protection and financial stability. Financial institutions should explore partnerships with Fintech companies to leverage their technological expertise and expand their reach to underserved populations. Fintech providers must focus on designing inclusive solutions that address the specific needs of marginalized communities, incorporating user-friendly interfaces and providing digital literacy training. Additionally, stakeholders should consider the potential for Fintech to contribute to sustainable development goals (SDGs) by integrating environmentally sustainable practices into their operations. Addressing the identified challenges and leveraging the opportunities presented by Fintech can significantly enhance financial inclusion and drive economic growth.

6. Conclusion

   This literature review has examined the role of Financial Technology (Fintech) in promoting financial inclusion, revealing that Fintech innovations play a critical role in overcoming traditional barriers and providing accessible financial services to underserved populations. By synthesizing findings from a wide range of academic papers, reports, and case studies, the review highlights the mechanisms through which Fintech promotes financial inclusion, such as mobile banking, peer-to-peer lending, and digital payments. It also identifies challenges, including regulatory barriers, cybersecurity risks, and digital literacy issues, that must be addressed to fully realize the potential of Fintech. The findings offer valuable insights for policymakers, financial institutions, and Fintech providers, emphasizing the need for supportive regulatory frameworks, inclusive product design, and digital literacy initiatives. Future research should focus on cross-regional comparisons, longitudinal studies, detailed mechanisms of impact, and the intersection of Fintech with environmental sustainability to further enhance our understanding of Fintech's role in promoting financial inclusion. Addressing these gaps will help in developing strategies that maximize the benefits of Fintech, contributing to broader financial empowerment and economic development.

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Green Human Resource Management Towards Digital Transformation in Municipalities in Irbid Governorate

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C H R O N I C L E	A B S T R A C T
	This paper aims to investigate the green human resource management towards digital transformation in municipalities in Irbid governorate. More specifically, the study focused on managing green human resources through selection, appointment, training, development, motivation, rewards, and performance appraisal. The first and second order construct towards digital transformation in order to improve municipalities performance. Nevertheless, partial least squares (Smart -PLS-4.0.8.7) were used to test the hypotheses, the results indicate that green human resource management positively affect the digital transformation, green human resource management also positively affect the municipalities performance. In addition, digital transformation mediates the effect of green human resource management on municipalities performance. However, the importance of the practical study for decision makers in the higher administrations in Irbid municipality is represented by providing them with the importance of green human resource management and its role in improving performance through digital transformation, the results of this study also contribute to providing decision makers and policy makers with creating a green business environment that contributes to preserving and preserving the organization's property.

1. Introduction

The practice of managing green human resources is one of the contemporary issues that emerged as a result of the urgent need and the high response to the initiatives of international organizations that play their role in preserving the environment and its resources, as well as technological development and the expansion of global industries and businesses, in addition to the practices and impacts left by these industries and businesses on the environment. Which contributed greatly to the increase in environmental degradation and the spread of pollution in general. And through the novelty of the concept of green human resource management within organizations and the global interest in it, this led to an increase in awareness of the importance of environmental issues and forced them to adopt environmentally friendly practices, the most important of which is green human resource management, which contributed to reducing costs, increasing human competencies and attracting them to improve productivity, which increased of creativity and

excellence in organizations (Sudin, 2011). The importance of green management in general has also emerged in achieving safety in providing products and managing operations, which prompts the organization to raise the efficiency of its production operations, reduce levels of damage and environmental pollution resulting from production processes, as well as avoid legal prosecutions leading to paying compensation to those affected, and inciting environmental and citizen protection associations.

Green human resource management is defined as the contribution of human resource management policies and practices to preserving the environment by defining the organization's directions and activities in protecting and preserving natural resources and working to adopt and encourage green initiatives by increasing employees' awareness and commitment to sustainable environmental issues (Omar, 2019). Green human resource management is an aspect of human resource management and practice. It is not limited to the general functions of human resource management only, but this concept included the inclusion of environmental management and the reduction of environmental pollution practices. This is done through the use of green training, development and evaluation, green recruitment of employees and raising their skills, abilities and professional behaviors in a way that reflects the organization's concern for the environment and reducing wrong practices towards the environment (Al-Sakarna, 2017). The practice of green human resources management helps in achieving social acceptance and good reputation for the organization, and environmental commitment helps the organization to gain social support for it, to consolidate its relations with its current clients and win new clients in the future, and to find solutions to many environmental and social problems, as it cares and focuses on health and the safety of workers, given that organizations adopt the green environment method as a way to achieve competitive advantage and increase the profits of the organization in addition to preserving the environment and the continuity of its activities (Al-Salhi, 2012).

One of the most important pillars on which green human resource management is based is the protection of employees from work risks and professional errors that the employee may be exposed to, which may cause partial or total disability and sometimes death as a result of lack of training and rehabilitation or taking corrective measures based on the performance evaluation system and the provision of security and safety measures professionalism of employees (Skibińska & Kott, 2015). Green human resources management plays a vital role in training employees and equipping them with the knowledge and skills necessary to master the duties entrusted to them to achieve benefit at all levels, whether for themselves, the organization or the environment. The Green Human Resources Department also works to provide a pollution-free work environment while employees perform their duties by developing environmental citizenship behavior among them and maintaining a high level of adherence to occupational safety and security regulations and instructions for workers. Green human resource management practices for organizations are an important approach that helps achieve a culture of sustainability (Sudin, 2011).

This paper aims to investigate the impact of Green Human Resource Management (GHRM) on digital transformation within the municipalities of Irbid Governorate. Specifically, the study seeks to examine how municipalities implement GHRM practices, including selection, appointment, training, development, motivation, rewards, and performance appraisal. It also aims to evaluate the influence of these practices on digital transformation processes and analyse their impact on the overall performance of municipalities. Additionally, the research investigates the mediating role of digital transformation in the relationship between GHRM and municipal performance. The study aims to provide practical recommendations for higher administration decision-makers in Irbid municipalities on the importance of GHRM and its role in enhancing performance through digital transformation. Furthermore, it seeks to contribute to the development of policies and strategies that foster a green business environment, aiding in the conservation of organizational resources and promoting sustainable practices.

2. Literature Review

GHRMis concerned with the organization and management of human resources with the environmental objectives of the organization and the society in which it operates. There are different definitions of the concept of green human resource management, and in general they all seek to clarify the need to achieve a balance between growth and industrial development, to protect the natural environment for the prosperity of future generations (Al-Habib et al., 2014). GHRMcan be defined as following human resource management policies to promote the sustainable use of resources within organizations in a way that preserves the environment (Marhatta & Adhikari, 2013). However, GHRM is also referred to as all the activities involved in the development, implementation and ongoing maintenance of a system aimed at

making the organization's employees friends in order to achieve the organization's environmental goals and make a significant contribution to environmental sustainability, as GHRM refers to policies, practices and systems that increase From the awareness, awareness and interest of the organization's employees in the work environment and the society in which it operates (Opatha and Arulrajah, 2013).

Daoud and Ali (2017) focused on the concept of green human resources management, which includes stimulating and increasing employee participation in environmental activities and achieving environmental sustainability by retaining talented employees who have the desire and motivation to practice environmentally friendly activities. In addition, Al-Sakarneh (2017) also believes that GHRM goes beyond the limits of the social responsibility of organizations, as it plays an important role in solving problems related to the environment by training employees about the requirements for implementing laws related to environmental safety. However, green human resources management plays an important role in environmentally friendly activities, by involving employees as part of green initiatives by adopting practices such as employee participation, knowledge management, selection, training, and encouraging diversity to improve the company's environment (Al-Taher et al., 2019). Moreover, green human resources management also became an integral part of the work strategy of organizations in all its forms during the nineties of the last century, by promoting the importance of GHRM directions. For example, a partnership initiative was launched between the United Nations Environment Program, the International Federation of Labor Waste and the International Organization of Employers And the International Labor Organization, as it seeks to promote opportunities, equity, and a just transition to a green economy while providing green jobs that care about the environment, which have become safer and enjoy better wages compared to jobs in similar sectors. The contribution of green human resources management is not limited to the framework of human resources management practices, but extends It refers to the functional areas of green management, including green operations, green marketing, supply chain management, accounting and green financing, and thus carries a holistic view in order to align employees with the environmental strategy of the organization (Mishra, et al., 2014).

GHRM practices play a vital role in enhancing the morale of employees, which may help in achieving a great deal of benefit for both the company and the employees. There are a number of advantages that the organization can achieve as a result of introducing the principles of GHRM at work (Jacob and Cherian, 2012). Also, environmental practices improve company performance and provide a competitive advantage, so companies become interested in environmental issues, and GHRM may play a key role in environmental management. This is a new approach to achieving the human resource function, whose nature is to include environmental goals in all sub-areas of resource management. human resources, from recruitment planning, selection, motivation and development of employees, to their evaluation and impact on work (Bombiak & Marciniuk-Kluska, 2018). Implementing GHRM and incentivizing environmentally oriented employee behavior is beneficial to organizations, as environmental policies in terms of recruitment, performance management, training, development, and rewards are powerful tools for engaging employees in the practical implementation of environmental protection strategies, and resource management tools, processes, and practices may Green humanity leads to increased employee involvement in the process of environmental innovations, reducing environmental waste, improving products, increasing process efficiency, and reducing costs (Carballo et al., 2017).

GHRM is concerned with the organization and management of human resources to align with the environmental objectives of both the organization and the broader society. Different definitions of GHRM generally emphasize the importance of achieving a balance between growth and industrial development while protecting the natural environment for future generations (Al-Habib et al., 2014). GHRM can be defined as following human resource management policies to promote the sustainable use of resources within organizations in a way that preserves the environment (Marhatta & Adhikari, 2013). It encompasses all activities involved in developing, implementing, and maintaining systems that encourage employees to contribute to the organization's environmental goals and promote environmental sustainability. This includes policies, practices, and systems that increase awareness and interest in environmental issues among employees (Opatha & Arulrajah, 2013). Daoud and Ali (2017) highlighted that GHRM includes stimulating and increasing employee participation in environmental activities and achieving environmental sustainability by retaining motivated employees who practice environmentally friendly activities. Al-Sakarneh (2017) also emphasized that GHRM extends beyond corporate social responsibility by training employees on environmental safety laws. Furthermore, GHRM involves employees in green initiatives

through practices such as participation, knowledge management, selection, training, and encouraging diversity, which enhances the company's environmental performance (Al-Taher et al., 2019). In the 1990s, GHRM became integral to organizational strategies, with initiatives promoting green jobs that prioritize environmental care, safety, and better wages. This shift included partnerships among the United Nations Environment Program, the International Federation of Labor Waste, the International Organization of Employers, and the International Labor Organization, aiming for a just transition to a green economy (Mishra et al., 2014). GHRM practices extend to various functional areas, including green operations, marketing, supply chain management, accounting, and financing, aligning employees with the organization's environmental strategy.

GHRM practices enhance employee morale and benefit both the company and its employees by introducing green principles at work (Jacob & Cherian, 2012). These practices improve company performance, provide a competitive advantage, and play a key role in environmental management by integrating environmental goals into all aspects of human resource management, from recruitment to employee evaluation (Bombiak & Marciniuk-Kluska, 2018). Implementing GHRM and incentivizing environmentally oriented behavior is advantageous for organizations. Environmental policies in recruitment, performance management, training, development, and rewards are powerful tools for engaging employees in environmental protection strategies. These tools and practices can increase employee involvement in environmental innovations, reduce environmental waste, improve products, enhance process efficiency, and lower costs (Carballo et al., 2017). Thus, GHRM focuses on aligning human resource practices with environmental objectives to achieve sustainable growth and industrial development while protecting the natural environment. It involves implementing policies that promote sustainable resource use and developing systems to encourage employees to support environmental goals. GHRM extends beyond corporate social responsibility by training employees in environmental safety and involving them in green initiatives, which enhances company performance and provides a competitive advantage. By integrating environmental goals into all aspects of human resource management, GHRM improves employee morale, increases involvement in environmental innovations, reduces waste, and enhances efficiency, ultimately benefiting both the organization and its employees.

3. Hypothesis Development

The increasing focus on sustainability and digital innovation in organizational management has led to the emergence of Green Human Resource Management (GHRM) as a pivotal strategy for enhancing both environmental and operational performance. This study aims to explore the relationships between GHRM, digital transformation, and municipal performance, positing three key hypotheses. Firstly, the hypothesis (H1) suggests that GHRM practices positively influence digital transformation. As organizations integrate eco-friendly practices into their human resource management, they create a culture of innovation and adaptability, essential for digital advancements. Secondly, the hypothesis (H2) proposes that GHRM directly impacts the performance of municipalities. By fostering sustainable practices and environmental awareness among employees, municipalities can enhance their operational efficiency and service delivery, leading to improved overall performance. Finally, the hypothesis (H3) posits that digital transformation mediates the relationship between GHRM and municipal performance. This suggests that while GHRM directly improves municipal performance, its full potential is realized when combined with effective digital transformation strategies, highlighting the interconnectedness of sustainability and technology in modern organizational frameworks. For example, Abu Khashim (2020) aimed to know the effect of applying occupational safety and security rules on improving workers' performance. The researcher relied on the descriptive approach, and the study found that there is a statistically significant effect of applying the rules of occupational security and safety in improving the performance of workers, and there is a weak correlation between regulations and laws and improving the performance of workers. The study also showed that the company adopts clear and specific laws and regulations, but the company's management does not Direct and periodic follow-up of the implementation of occupational safety procedures. Suharti and Sugiarto (2020) found that implementing green HRM provided benefits to individual employees and to the organization. Employees had better green work results, and at the same time, at the organizational level, the benefits of implementing green human resource management were to create an environmentally friendly organizational culture and work climate, increase the efficiency of various resources, form a positive image of the organization and increase economic and environmental performance. This study is expected to contribute to expanding the

literature on the implementation of green HRM and its benefits to companies. Song, (2020) indicated that green human resource management can positively influence green innovation, and that green human capital mediates the relationship between green human resource management and green innovation. In addition, management environment concerns mitigate the impact of green human resource management on green human capital. The results further revealed that the indirect impact of green human resource management on green innovation through green human capital is important for companies that have a high concern in their work environment. Boukhalkhal and Al-Toumi (2019) aimed to identify the extent of workers' attitudes towards the effectiveness of occupational safety measures in reducing work accidents, and to identify workers' attitudes towards the effectiveness of occupational safety measures in reducing work accidents among company workers. The study relied on the analytical descriptive approach, and the sample consisted of (37) workers from the category of executive workers. The results of the study showed that the workers' attitudes are positive towards the effectiveness of occupational safety measures in reducing work accidents, and positive towards the institution's commitment to providing equipment and tools for occupational safety procedures, and towards the institution's commitment to training workers on occupational safety procedures and the institution's commitment to applying occupational safety procedures.

Al-Taher (2019) aimed the study to identify the impact of green human resource management on creativity. Where the study relied on the descriptive analysis approach, the study concluded that there is an inverse relationship between the orientation of green human resources management and the creativity of workers, and one of the applied implications of the study is that it may help decision-makers to better understand the orientation of green human resource management, and the study recommended that future studies focus on Conducting more studies on the relationship between green human resources management orientation and creativity. Al Mamun, (2019) examine the extent of awareness of green human resource management among different levels of human resource managers from different organizations in Bangladesh, where a combination of quantitative and qualitative research methods were used to collect information. The results revealed that the knowledge of green human resource management depends on various factors, as the study focused on increasing the level of awareness about green human resource management among managers from various sectors in Bangladesh, and organizations should employ green human resource management practices required to achieve excellent organizational performance. Moreover, the government may develop policies to promote these practices, as achieving organizational excellence will reflect positively on the economy in the long run, and all of this can be facilitated through proactive regulatory and national human resources development initiatives.

Yong et al., (2019) outlined the factors facilitating the adoption of green HRM in Malaysia. The data required for this study were collected using semi-structured face-to-face interviews with HR managers and managers from four large manufacturing companies in Malaysia. The results of the study revealed that there are four main factors affecting the adoption of green HRM including stakeholder pressure, comparative advantage, perceived benefits from implementing green HRM, commitment of senior management and green intellectual capital, which means that intellectual capital integrates green innovation or Green environment, and that among the three dimensions of green intellectual capital, green human capital and green structured capital were discussed significantly only by human resource managers and managers, while the role of relational green capital in adopting human resource management was not noticed green.

Al-Ruwaili (2018) examined the role of human resource management practices in promoting a green culture among employees, which will directly affect their performance and behaviour in terms of respecting environmental values and carrying out environmental processes to produce employees and green products that attract consumers. The results indicated that there is a significant impact of green human resource practices on creating green organizational behaviour through the acquisition of environmental employees who enable the organization to work through green instructions and methods. Organization managers are advised to deal with environmental values and clear provisions to protect environmental values. According to the above as shown in *Figure (1)*., the following hypothesis can be reached:

H1: Green human resource management on Digital Transformation.
H2: Green human resource management on Municipalities Performance.
H3: Digital Transformation mediate the effect of Green human resource management on Municipalities Performance.
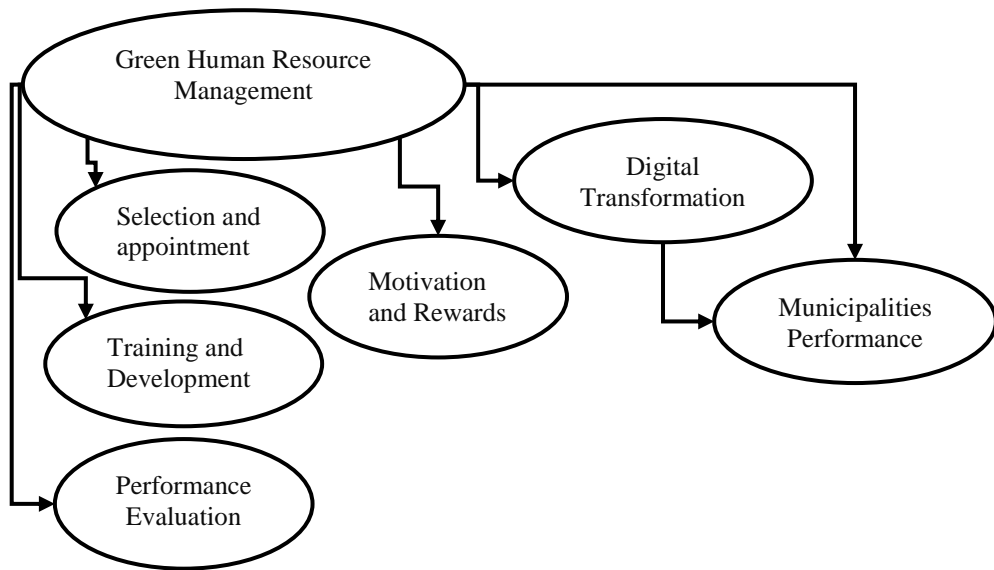
Figure 1. Research Model

4. Methodology

The field analytical descriptive approach was adopted in describing the variables of the study, the impact of green human resources management in its axes (selection and appointment, training and development, motivation and rewards, and performance evaluation), by distributing a questionnaire to the members of the study sample in order to obtain data on the study sample and their opinions. The study population consisted of all workers in Irbid municipalities. (435) questionnaires were distributed, of which (303) were retrieved. After reviewing the questionnaires, it was found that there are (9) questionnaires that are not valid for statistical analysis because their answers are not complete. Thus, the study sample consisted of (294) male and female employees. The questionnaire also consisted of (18) items that reflect the agreement of the study sample members on the dimensions of the independent variable represented in green human resource management, based on a group of previous studies such as the study of Fathi (2020), the study of Al-Rumaidi et al. (2020).

5. Findings

The Variance Inflation Factor (VIF) and Tolerance values were used in order to ensure that the data is free from the problem of linear duplication between the independent variables, which is the problem whose existence means that an independent variable is a function of another independent variable, that is, it rises with its height and decreases with its decrease. However, VIF found that the study model is devoid of the problem of linear duplication between the independent variables, as the values of the Variation Inflation Coefficient (VIF) were appropriate in that they are less than (10), as well as the Tolerance values that met the acceptance criterion, which is that its value is greater than (0.05). Thus, it can be adopted that the study data take a normal distribution, and thus the possibility of conducting subsequent statistical analyses. However, *Figure (2)* shows Alpha Cronbach for the variables and items.
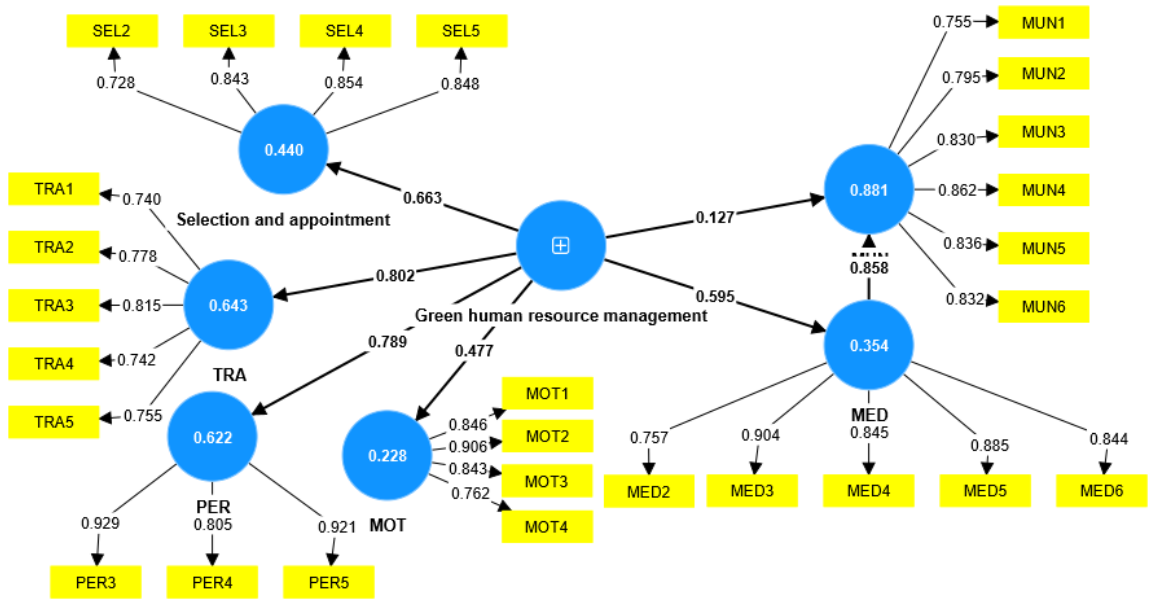
Figure 2. PLS_SEM Algorithm

The *Figure 2* above shows the Alpha Cronbach, which indicate that all items have a reliability and validity greater than 0.70% .In addition, Multiple regression analysis was performed according to (Stepwise), which is based on regression analysis, by including the most powerful variable contributing to the prediction of the dependent variable first in the analysis model, then the second most powerful variable is included in addition to the first variable, and so on until the All predictive variables, variables with low predictive power are not included as the dependent variable.

Figure 3. PLS_SEM Bootstrapping
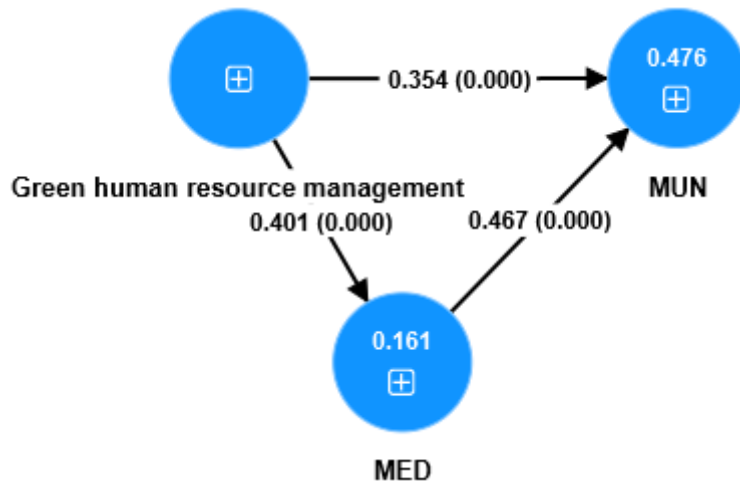
Based on *Figure 3* above, the analysis indicates that three dimensions of green HRM contributed to the prediction in the dependent variable .With regard to the implications of theoretical contributions, the study added a model for green human resource management practices by linking the human resource management axes. However, *Table 1* indicates the result of hypotheses Testing.

Table 1: Result of Mediation Testing

Path	β	STDEV	T-values	P Values
Green human resource management → Digital Transformation → Municipalities Performance	0.09	0.04	2.51	0.00
Green human resource management -> → Digital Transformation	0.13	0.05	2.15	0.00
Digital Transformation -> → Municipalities Performance	0.18	0.04	4.53	0.00

For H1, Green human resource management positively affect the Digital Transformation. This is because the indirect effect as shown is significant (B=0.09, T>1.96, P<0.05). Thus, H1 is supported. For H2, Green human resource management positively affect the Municipalities Performance. This is because the indirect effect as shown is significant (B=0.09, T>1.96, P<0.05). Thus, H1 is supported. In addition, for H3, Digital Transformation mediate the effect of Green human resource management on Municipalities Performance. This is because the indirect effect as shown is significant (B=0.09, T>1.96, P<0.05). Thus, H3 is supported. However, this paper reveals several key findings regarding the impact of GHRM on digital transformation and municipal performance. Firstly, the analysis confirms that GHRM practices significantly positively influence digital transformation within municipalities, supporting Hypothesis 1. This indicates that municipalities implementing eco-friendly HR practices are more likely to adopt and benefit from digital technologies. Secondly, Hypothesis 2 is validated, showing that GHRM directly enhances municipal performance. Municipalities with robust GHRM practices report better operational efficiency, higher employee morale, and improved service delivery. Lastly, the study confirms Hypothesis 3, demonstrating that digital transformation mediates the effect of GHRM on municipal performance. This mediation effect underscores the critical role of digital technologies in maximizing the benefits of GHRM initiatives, suggesting that the integration of GHRM and digital strategies leads to superior outcomes.

The findings of this study align with existing literature that emphasizes the critical role of Green Human Resource Management in driving organizational performance and innovation. According to Agha, Atwa, and Kiwan (2021), strategic intelligence, which encompasses environmental awareness and sustainable practices, significantly impacts firm performance and is mediated by strategic flexibility. This supports our finding that GHRM positively influences digital transformation and municipal performance by promoting a culture of sustainability and innovation. Ahmed et al. (2021) also highlight that strategic intelligence leads to a sustainable competitive advantage for small and medium enterprises. Similarly, our study demonstrates that GHRM practices enhance municipal performance by integrating sustainable practices into everyday operations, thus fostering a competitive edge in public sector performance. Moreover, Al Hada et al. (2021) discuss the relationship between strategic intelligence and psychological resilience, emphasizing that employees' involvement in environmental activities boosts their resilience and performance. This is reflected in our findings, where GHRM practices not only improve digital transformation efforts but also enhance overall employee morale and organizational performance. Al-Daouri and Atrach (2020) note the significant impact of strategic intelligence on strategic flexibility in the banking sector, which parallels our conclusion that digital transformation mediates the relationship between GHRM and municipal performance. This mediation effect underscores the importance of digital tools and technologies in amplifying the benefits of GHRM practices. Furthermore, the holistic approach to GHRM discussed by Alnoukari et al. (2016) aligns with our study's findings that GHRM practices extend beyond traditional HR functions to include green operations, marketing, supply chain management, and accounting. This comprehensive integration ensures that sustainable practices are embedded throughout the organization, leading to improved performance and sustainability. However, the integration of GHRM practices with digital transformation strategies is crucial for enhancing municipal performance. This study contributes to the growing body of literature by demonstrating the significant impact of GHRM on digital transformation and performance, providing valuable insights for policymakers and municipal leaders.

6. Implication

The findings of this study underscore the critical role of Green Human Resource Management (GHRM) in driving digital transformation and enhancing municipal performance. These results have several significant implications for policy development, training and development, strategic planning, resource allocation, organizational culture, and performance metrics. Policymakers should prioritize integrating GHRM practices into public administration to promote sustainability and operational efficiency. Comprehensive policies that support eco-friendly HR practices can lead to substantial improvements in digital transformation and overall municipal performance. Furthermore, municipalities should invest in training programs that educate employees about sustainable practices and digital skills. This dual focus can foster a workforce that is environmentally conscious and adept at leveraging digital tools for enhanced performance. In addition, Decision-makers in municipalities should incorporate GHRM into their strategic planning processes. By aligning GHRM with digital transformation initiatives, municipalities can create a synergistic effect that boosts both environmental sustainability and operational effectiveness. Effective implementation of GHRM and digital transformation requires adequate resources, and municipalities should allocate sufficient budgetary and human resources to support these initiatives, ensuring they are adequately funded and staffed.

Creating a culture that values sustainability and innovation is essential for the success of GHRM. Municipal leaders should promote a culture of continuous improvement where employees are encouraged to engage in green practices and embrace digital solutions. To measure the success of GHRM and digital transformation initiatives, municipalities should establish clear performance metrics. These metrics can help track progress, identify areas for improvement, and demonstrate the impact of these initiatives on overall municipal performance. However, integrating GHRM with digital transformation strategies is crucial for enhancing municipal performance. The study's insights provide valuable implications for policymakers, municipal leaders, and practitioners, underscoring the need for a holistic approach to sustainability and technology in public administration. By embracing GHRM and digital transformation, municipalities can achieve greater efficiency, sustainability, and service quality, ultimately benefiting the communities they serve.

7. Conclusion

This paper highlights the significant role of Green Human Resource Management (GHRM) in driving digital transformation and enhancing municipal performance. The findings confirm that GHRM practices positively influence digital transformation and directly improve municipal performance. Moreover, the mediation effect of digital transformation emphasizes the importance of integrating sustainable HR practices with digital strategies to achieve optimal outcomes. These insights provide valuable implications for policymakers, municipal leaders, and practitioners, underscoring the need for a holistic approach to sustainability and technology in public administration. By embracing GHRM and digital transformation, municipalities can achieve greater efficiency, sustainability, and service quality, ultimately benefiting the communities they serve. Moreover, for decision-makers in the higher administrations of Irbid municipality, the practical implications of this study are profound. It provides them with evidence of the importance of GHRM in improving performance through digital transformation. The success of many organizations is closely linked to their ability to develop qualified and trained human resources that implement occupational safety and environmental preservation procedures. The study's results are hoped to contribute to creating a green business environment that preserves organizational property and resources by establishing robust security and safety measures. This holistic approach can ensure that municipalities not only meet their performance goals but also contribute to broader environmental sustainability objectives.

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The moderating role of digital leadership between digital transformation and performance of vocational education teachers in public schools

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CHRONICLE	ABSTRACT
	This This paper aims to investigates the moderating role of digital leadership in the relationship between digital transformation and the performance of vocational education teachers in public schools. The research focuses on male and female vocational education teachers within government schools affiliated with the education directorates in Irbid Governorate, encompassing a total population of 447 teachers, with 199 males and the remainder females. A sample size of 105 teachers was selected through a simple random sampling method. Employing a descriptive analytical approach, data was processed using the Statistical Package for the Social Sciences (SPSS-29). The findings reveal statistically significant differences in the impact of digital transformation on the performance of vocational education teachers based on years of experience and academic qualifications. However, no significant differences were found related to the gender variable. Importantly, the study demonstrates that digital leadership enhances the positive effects of digital transformation on teachers' performance, underscoring its critical role. The study concludes that digital leadership plays a vital role in optimizing the benefits of digital transformation for vocational education teachers' performance in public schools, suggesting this area warrants further research. Additionally, the study recommends strengthening teacher support and encouragement through administrative efforts, enhancing teacher competencies, and providing a conducive classroom environment. Teachers should be motivated and provided opportunities to pursue further studies relevant to their specialization.

1. Introduction

Digital transformation has become an integral part of modern education, revolutionizing the teaching and learning process in classrooms. With the rapid advancement of technology, teachers face the challenge of integrating digital tools and technologies into their educational practices. Consequently, this shift towards digital teaching methods has a profound impact on teachers' performance and effectiveness in the classroom. However, the successful implementation of digital transformation in education heavily relies on the presence of effective digital leadership and support (Desouqi, 2022). Digital leadership refers to the vision, guidance, and support provided by educational leaders to ensure the seamless integration of technology into teaching practices (Al-Naimi & Hattamleh, 2023). In the context of digital transformation, leaders play a vital role in empowering teachers and enabling them to adopt and use digital tools effectively (Al-Semirat, 2023). On

the other hand, digital leaders provide teachers with the necessary resources, training, and professional development opportunities to enhance their digital competence. Digital leadership fosters a culture of innovation and risk-taking, encouraging teachers to experiment with new technological tools and teaching methods (Al-Naimi & Hattamleh, 2023). Furthermore, effective digital leadership promotes collaboration and communication among teachers, enabling them to share best practices and learn from each other. Strong and supportive digital leadership enhances the positive impacts of digital transformation on teachers' performance, leading to improved educational practices, student engagement, and outcomes. Conversely, the lack of digital leadership can hinder teachers' ability to use technology effectively and overcome the challenges associated with digital transformation (Shawish, 2022). However, the impact of digital transformation on teachers' performance is significant, offering numerous benefits such as access to resources, improved communication, and personalized learning experiences. However, the presence of effective digital leadership is essential to harness the full potential of digital transformation in education. Through their vision, support, and resources, digital leaders play a crucial role in enabling teachers to embrace technology and adapt their practices, ultimately enhancing the overall quality of education. The problem of this study is to identify the moderating role of digital leadership in the effect of digital transformation on the performance of vocational education teachers in public schools in Irbid Governorate. The study problem can be clarified through the following questions:

1. What is the performance level of vocational education teachers in public schools in Irbid Governorate, and what is the impact of digital transformation on it?
2. Are there statistically significant differences at the level ($\alpha \leq 0.05$) in the impact of digital transformation on the performance of vocational education teachers in public schools in Irbid Governorate attributed to variables (gender, academic qualification, number of years of experience)?
3. Are there statistically significant differences at the level ($\alpha \leq 0.05$) in the moderating role of digital leadership in the impact of digital transformation on the performance of vocational education teachers in public schools in Irbid Governorate?

This paper aims to identify the performance level of vocational education teachers in public schools in Irbid Governorate and the impact of digital transformation on it. Additionally, it seeks to determine whether the impact of digital transformation on the performance of vocational education teachers in public schools in Irbid Governorate is attributed to variables such as gender, academic qualification, and number of years of experience. Furthermore, this study aims to highlight the moderating role of digital leadership in the impact of digital transformation on the performance of vocational education teachers in public schools in Irbid Governorate.

2. Literature Review

The rapid advancement of digital technology has significantly transformed various sectors, including education. The integration of digital tools and practices in teaching has introduced new dynamics in educational environments, fundamentally altering the ways in which educators deliver instruction and interact with students. This literature review aims to explore the existing research on digital transformation in education, focusing on its impact on teachers' performance, the role of digital leadership, and the specific challenges and opportunities faced by vocational education teachers in public schools. Firstly, the review will examine the concept of digital transformation in education, highlighting its key components and the theoretical frameworks that underpin its implementation. This section will provide a comprehensive understanding of how digital transformation reshapes educational practices and outcomes. Secondly, the review will delve into the impact of digital transformation on teachers' performance. Various studies have indicated that the adoption of digital tools can enhance teaching effectiveness, improve student engagement, and facilitate personalized learning experiences. However, the extent of these benefits can vary based on several factors, including the teachers' proficiency with technology, the availability of resources, and the overall support from the educational leadership. Thirdly, the review will explore the critical role of digital leadership in facilitating successful digital transformation. Effective digital leadership involves providing vision, guidance, and support to ensure the seamless integration of technology into teaching practices. Leaders in education play a pivotal role in fostering a culture of innovation, encouraging professional development, and creating an environment conducive to digital learning. Additionally, the review will address the specific context of vocational education teachers in public schools. Vocational education, with its focus on practical and skills-based learning, presents unique challenges and opportunities for digital

transformation. The literature will be examined to identify how digital tools can enhance vocational training and how teachers can be supported in adopting these technologies. Finally, the review will consider the moderating effects of digital leadership on the relationship between digital transformation and teachers' performance. Understanding these dynamics is crucial for developing strategies that maximize the positive impacts of digital transformation on educational outcomes. However, this literature review aims to synthesize the current research on digital transformation in education, with a particular focus on the performance of vocational education teachers and the role of digital leadership. By examining these areas, the review seeks to provide a comprehensive foundation for understanding the complexities and implications of digital transformation in the educational context.

Digital transformation presents a broad spectrum of benefits for teachers, enabling access to an extensive range of resources and educational materials that facilitate the development of engaging and interactive lessons. Teachers can utilize online platforms, educational apps, and digital content to supplement traditional teaching methods and provide personalized learning experiences for their students. Digital tools also enhance effective communication between teachers, students, and parents. It is crucial to study the impact of digital leadership, which oversees learning management systems, collaborative platforms, and communication applications for teachers. These tools enable interaction with students beyond classroom walls, provide instant feedback, track progress, and meet individual needs, thereby enhancing the overall learning experience and fostering a more productive and inclusive educational environment. Furthermore, Na'imi and Hattamleh (2023) examined the role of digital leadership in improving teacher performance in the Bani Ubaid District Education Directorate. Using a descriptive survey method and a sample of 385 teachers, the study found a significant role of digital leadership in enhancing teacher performance, particularly in professional practice, digital culture and learning, and digital citizenship. Razak et al. (2023) aimed to provide a theoretical understanding of digital learning transformation among public school teachers. Analyzing 42 articles from Scopus databases, the study identified significant themes and barriers to digital transformation, highlighting the importance of strategic policy-making for sustainable education and effective teaching performance. Moreover, Abuajwa et al. (2023) focused on digital leadership and readiness for change in Palestinian higher education institutions. Using a descriptive-analytical method and a sample of supervisory staff, the study revealed a positive impact of digital leadership on change readiness, emphasizing the importance of digital skills and continuous professional development.

Mohamed (2023) explored digital transformation requirements and challenges in Egyptian educational institutions. The study identified key requirements, such as updated regulations, re-engineered structures, robust IT infrastructure, and continuous learning programs. Major challenges included administrative resistance, lack of financial resources, and limited awareness of digital transformation's importance. Al-Semirat (2023) investigated digital leadership drivers among school leaders in Karak Governorate during remote learning. Using a descriptive method and a sample of 127 administrators and teachers, the study found significant effects of administrative and digital support, leadership skills, and digital culture on digital leadership, with recommendations for incentivizing leaders who implement digital practices. Carvalho et al. (2022) also analyzed the relationship between leadership styles, digital transformation, and performance in higher education institutions. A systematic literature review revealed that transformational leadership was most commonly associated with digital transformation, which is essential for enhancing educational activities and adopting online learning technologies. In addition, Shawish (2022) examined the role of digital leadership in promoting digital literacy among teachers from the perspective of school principals in the Qasaba Amman District. Using a descriptive survey method, the study found a high degree of digital leadership's impact on developing computational thinking, critical thinking, and content creation, with no significant differences based on gender or experience. However, this review synthesizes the current research on digital transformation, teacher performance, and digital leadership, highlighting their interconnectedness and the critical role of effective leadership in fostering a conducive environment for digital innovation in education.

2.1 Digital Transformation

Digital transformation in education refers to the use of digital technologies to enhance the learning experience for students, teachers, and administrators. It can help streamline administrative tasks, improve the quality and relevance of learning, and promote inclusion (Truong & Diep, 2023). However, digital transformation is a phenomenon driven by a suite of modern digital technologies operating synchronously,

such as computers, artificial intelligence, and cloud computing. This transformation generates vast amounts of new information that can aid in decision-making and strategic planning (Lanzolla et al., 2020). Implementing digital transformation across various sectors enhances efficiency and improves organizational performance in multiple dimensions. It is also linked to increased innovation, productivity, financial performance, company growth, reputation, and competitive advantage (Vial, 2019). Educational systems must adapt to equip students with the skills necessary to build a more just and productive society. Schools should provide hard skills like technology design and resource management, as well as soft skills like communication, empathy, and social awareness, enabling students to shape inclusive and fair communities. These skills are essential for enabling people to thrive in a more complex, interconnected, and rapidly changing world (Truong & Diep, 2023).

2.2 Teacher Performance

Teacher performance encompasses the behaviors, attitudes, and actions within the teaching and learning environment that contribute to achieving students' educational goals (Kilag et al., 2023). Teachers must continuously enhance their skills to keep up with the latest trends, educational methods, and technologies in the education sector (Abu Khairan & Rantisi, 2023). Ensuring that content remains up-to-date and applicable is crucial for effectively meeting students' educational requirements and facilitating their optimal development. Teacher performance refers to the observable outcomes in the classroom that indicate the effectiveness or ineffectiveness of training and development. It includes actions, attitudes, and behaviors exhibited in the teaching and learning environment that contribute to achieving students' educational goals (Al-Juhani & Al-Harthi, 2023). Performance is a critical aspect of organizational management due to its significant role in achieving organizational goals with maximum efficiency and effectiveness. Teachers are expected to possess the pedagogical expertise and skills necessary for effective communication with their students. While a comprehensive understanding of content is essential, it does not guarantee efficient teaching. Teachers must be capable of delivering educational content or experiences in ways that ensure optimal learning outcomes when students engage in learning activities. Additionally, the subject matter should be communicated and presented in a manner that captivates students and enhances their educational experience (Tjabolo, 2020). Moreover, teachers need to effectively manage a range of routine responsibilities, such as managing teaching programs, ensuring proper organization and maintenance of laboratory equipment, coordinating guest lecturers, arranging and supervising school trips, and promptly handling registration change requests, among many other tasks (Rababaah, 2022). Ensuring and retaining highly skilled teachers is critical for providing high-quality education in schools. Teacher effectiveness is evaluated based on their performance, which is influenced by factors such as salary, working conditions, and job motivation.

2.3 Digital Leadership

Digital leadership is defined as the integration of digital technologies, such as mobile devices, communication applications, and web applications, into the leadership practices of school leaders towards sustainable change in technology use in schools. In essence, digital leadership is a combination of leaders, resources, devices, and technology (Yusof et al., 2019). Digital leaders differ from other leaders in terms of skills, attitudes, knowledge, and their professional and personal experiences. Digital leaders must possess flexibility, adaptability, intellectual curiosity, and a willingness to acquire new knowledge. They should be open to continuous learning by seeking solutions globally and constantly encourage their collaborators and followers to learn (Karakose et al., 2021). In addition, the strategic importance of digital leadership is evident in its role in supporting and assisting staff in educational institutions to streamline administrative procedures and facilitate decision-making processes. It also enables leaders to plan efficiently and effectively to meet work requirements and deliver high-quality outputs according to technical and other standards that meet modern demands and achieve their intended purposes (Al-Otaibi, 2023). Digital leadership differs from traditional leadership in that it "does not focus on the characteristics or actions of leaders; instead, it emphasizes that leaders must develop, guide, manage, and apply technology to various organizational processes to enhance operational performance. Applying leadership skills is essential for leaders to help their organizations adopt technology beneficially and prepare their institutions for the 21st century" (Mehibel & Haqah, 2023).

3. Hypothesis Development

Digital transformation offers a wide range of benefits for teachers by enabling access to a vast array of resources and educational materials, which facilitates the development of engaging and interactive lessons. Teachers can leverage online platforms, educational apps, and digital content to supplement traditional teaching methods and provide personalized learning experiences for their students. Digital tools also enhance effective communication between teachers, students, and parents. It is crucial to study the impact of digital leadership overseeing learning management systems, collaborative platforms, and communication applications for teachers. These tools enable interaction with students beyond classroom walls, provide instant feedback, track progress, and meet individual needs. This level of connectivity enhances the overall learning experience and fosters a more productive and inclusive educational environment.

Digital transformation, driven by technologies such as computers, artificial intelligence, and cloud computing, generates vast amounts of new information that aid decision-making and strategic planning (Lanzolla et al., 2020). The implementation of digital transformation in education enhances efficiency, innovation, productivity, financial performance, company growth, reputation, and competitive advantage (Vial, 2019). Educational systems must adapt to equip students with the necessary skills for a just and productive society, including hard skills like technology design and resource management, and soft skills like communication, empathy, and social awareness (Truong & Diep, 2023). This dual focus ensures that students are prepared to thrive in a complex, interconnected, and rapidly changing world. Furthermore, teachers need to continually update their skills to stay current with trends, educational methods, and technologies (Abu Khairan & Rantisi, 2023). Teacher performance encompasses behaviors, attitudes, and actions within the educational environment that achieve students' educational goals (Al-Juhani & Al-Harthi, 2023). Effective teaching requires both comprehensive content knowledge and the ability to deliver it in ways that ensure optimal learning outcomes (Tjabolo, 2020). Additionally, teachers must manage various responsibilities, including organizing teaching programs and maintaining equipment (Rababaah, 2022). Retaining highly skilled teachers is crucial for high-quality education, with their effectiveness influenced by factors such as salary, working conditions, and motivation.

Digital leadership plays a pivotal role in integrating digital technologies into educational practices. Digital leaders must be flexible, adaptable, and open to continuous learning, encouraging their teams to do the same (Karakose et al., 2021). They support educational staff by streamlining administrative procedures, facilitating decision-making, and enabling effective planning and high-quality performance (Al-Otaibi, 2023). Unlike traditional leadership, digital leadership focuses on developing, guiding, managing, and applying technology to improve organizational performance (Mehibel & Haqah, 2023). Additionally, Na'imi and Hattamleh (2023) examined the role of digital leadership in improving teacher performance in the Bani Ubaid District Education Directorate. Using a descriptive survey method and a sample of 385 teachers, the study found a significant role of digital leadership in enhancing teacher performance, particularly in professional practice, digital culture and learning, and digital citizenship. This study underscores the importance of digital leadership in fostering a supportive environment for digital transformation.

Razak et al. (2023) aimed to provide a theoretical understanding of digital learning transformation among public school teachers. Analyzing 42 articles from Scopus databases, the study identified significant themes and barriers to digital transformation, highlighting the importance of strategic policy-making for sustainable education and effective teaching performance. This study emphasizes the need for a structured approach to overcome the barriers to digital transformation in education. Furthermore, Abuajwa et al. (2023) focused on digital leadership and readiness for change in Palestinian higher education institutions. Using a descriptive-analytical method and a sample of supervisory staff, the study revealed a positive impact of digital leadership on change readiness, emphasizing the importance of digital skills and continuous professional development. This research highlights the crucial role of digital leadership in preparing educational institutions for change and innovation. In addition, Mohamed (2023) explored digital transformation requirements and challenges in Egyptian educational institutions. The study identified key requirements, such as updated regulations, re-engineered structures, robust IT infrastructure, and continuous learning programs. Major challenges included administrative resistance, lack of financial resources, and limited awareness of digital transformation's importance. This study provides a comprehensive overview of the necessary conditions and obstacles for successful digital transformation. Al-Semirat (2023) investigated digital leadership drivers

among school leaders in Karak Governorate during remote learning. Using a descriptive method and a sample of 127 administrators and teachers, the study found significant effects of administrative and digital support, leadership skills, and digital culture on digital leadership, with recommendations for incentivizing leaders who implement digital practices. This study offers practical insights into fostering effective digital leadership in educational settings. Furthermore, Carvalho et al. (2022) analyzed the relationship between leadership styles, digital transformation, and performance in higher education institutions. A systematic literature review revealed that transformational leadership was most commonly associated with digital transformation, which is essential for enhancing educational activities and adopting online learning technologies. This study highlights the importance of adopting appropriate leadership styles to facilitate digital transformation. Shawish (2022) examined the role of digital leadership in promoting digital literacy among teachers from the perspective of school principals in the Qasaba Amman District. Using a descriptive survey method, the study found a high degree of digital leadership's impact on developing computational thinking, critical thinking, and content creation, with no significant differences based on gender or experience. This study demonstrates the effectiveness of digital leadership in enhancing key digital competencies among teachers. However, the above literature highlights the critical role of digital leadership in facilitating digital transformation in education. Effective digital leadership not only supports the integration of technology but also fosters a culture of continuous learning and innovation, essential for improving teacher performance and achieving educational goals as shown in *Figure 1*. Thus, the following hypotheses can be proposed:

H1: Blockchain technology significantly enhances the accuracy of financial reporting in the UAE.

H2: Blockchain technology significantly improves the transparency of financial reporting practices in the UAE.

H3: The adoption of blockchain technology significantly reduces the risk of fraud in financial reporting in the UAE.
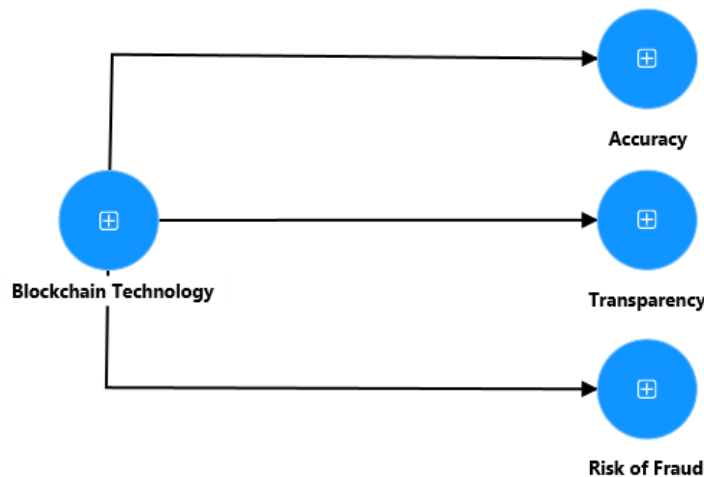

Figure 1. Research Model

4. Methodology

The methodology and procedures section provide a detailed description of the study's design, population, sample, tools, validity and reliability indicators, variables, procedures, and statistical treatments used to address the research questions. The study utilized a descriptive-analytical method to investigate the impact of digital transformation on the performance of vocational education teachers, considering the moderating role of digital leadership. To achieve the study's objectives of uncovering the effect of digital transformation on the performance of vocational education teachers, the researcher developed a measurement scale after reviewing relevant educational literature, sources, references, and related studies. The initial version of the scale consisted of 40 items, distributed across three domains: teacher performance, digital transformation, and digital leadership. The study population included all vocational education teachers in public schools under the education directorates in Irbid Governorate, totalling 447 teachers, with 199 males and the remainder females. A simple random sampling method was used to select a sample of

105 teachers, based on Morgan's table for sample size selection. The demographic breakdown of the study sample shown in *Table 1* as follows.

Table 1: Description of Study Sample by Demographic Variables

Variable	Category	Number	Percentage (%)
Gender	Male	5.00	4.80
	Female	100.00	95.20
Academic Qualification	Bachelor's Degree	63.00	60.00
	Postgraduate	42.00	40.00
Years of Experience	Less than 5 years	13.00	12.40
	5 to less than 10 years	20.00	19.00
	More than 10 years	72.00	68.60
Total		105.00	100.00

To ensure the validity and reliability of the questionnaire, the study employed rigorous procedures. The development and validation process of the instrument involved a comprehensive review of existing literature and feedback from experts in the field, ensuring that the items accurately measured the intended constructs and were consistent over time. The use of a descriptive-analytical approach allowed for a thorough examination of the variables and their interactions. This method provided insights into how digital transformation impacts vocational education teachers' performance and how digital leadership moderates this relationship. The statistical treatments applied in this study included various techniques to analyze the collected data and answer the research questions effectively.

5. Findings

The face validity of the scale was confirmed by presenting its initial version to a panel of seven experts in the field of educational administration. These experts reviewed the scale for its accuracy and content validity, assessing each item's relevance, clarity, linguistic formulation, and suitability for measuring the intended construct. Based on their feedback, modifications were made, including rephrasing some items for greater clarity and removing inappropriate ones. The criterion for accepting or excluding items was achieving 80% agreement among the experts. Following this review, the scale was refined to include 30 items divided into three domains: teacher performance (items 1-10), digital transformation (items 11-20), and digital leadership (items 21-30). To verify construct validity, the scale was administered to a pilot sample of 30 teachers who were not part of the main study sample. Pearson correlation coefficients were calculated to determine the item-total correlations within each domain. The correlation coefficients for teacher performance ranged from 0.53 to 0.71, for digital transformation from 0.48 to 0.74, and for digital leadership from 0.45 to 0.76. All these values were statistically significant at the 0.05 level, indicating acceptable levels of construct validity according to Audeh (2010). These results supported the retention of all items in the scale. However, to estimate the internal consistency reliability of the scale, Cronbach's alpha was calculated using the data from the initial pilot sample of 30 teachers. The Cronbach's alpha values were 0.74 for the domain of teacher performance, 0.76 for the domain of digital transformation, and similarly high for digital leadership, indicating good internal consistency. Additionally, test-retest reliability was assessed by re-administering the scale to the same pilot sample with a two-week interval between the first and second administrations. Pearson correlation coefficients between the two administrations were 0.83 for teacher performance and 0.80 for digital leadership, suggesting strong test-retest reliability. These reliability coefficients indicate that the scale is stable over time and consistently measures the intended constructs. However, this are shown in *Table 2* as follows.

Table 2: Means and Standard Deviations of Vocational Education Teachers' Performance

Importance Level	Rank	Standard Deviation	Mean	Item
High	1	0.96	3.87	Focus on developing teachers' performance using modern teaching methods
High	2	1.06	3.76	Teachers are adequately provided with professional studies
Moderate	3	0.85	3.60	Encouraging teachers to teach different curricula through IT
Moderate	4	0.99	3.53	Teacher performance is evaluated using advanced assessment models
Moderate	5	0.89	3.51	The school provides teachers with clear strategies to develop their abilities
Moderate	6	0.88	3.40	Focus on teachers' self-motivation as a modern approach
Moderate	7	1.04	3.32	Raising the cultural level of primary education teachers by providing diverse educational cultures
Moderate	8	0.99	3.31	Enhancing teachers' efforts and encouraging them through administration
Moderate	9	0.92	3.25	Developing teachers' competencies and providing a conducive classroom environment
Moderate	10	0.93	3.05	Encouraging teachers and providing opportunities for academic advancement in their specialization
Moderate	-	0.94	3.46	Overall mean

Table 2 above, presents the means and standard deviations for the performance of vocational education teachers. The mean values ranged from 3.87 to 3.05, with the overall mean for the scale being 3.46 and a standard deviation of 0.94, indicating a moderate level of performance overall. The scores varied between high and moderate, reflecting different aspects of teacher performance as influenced by digital transformation and digital leadership. However, the highest mean score (3.87) was for the item "Focus on developing teachers' performance using modern teaching methods," with a standard deviation of 0.96, indicating a high level of importance. This suggests that the use of modern teaching methods is seen as a crucial factor in enhancing teacher performance. The lowest mean score (3.05) was for the item "Encouraging teachers and providing opportunities for academic advancement in their specialization," with a standard deviation of 0.93, indicating a moderate level of importance. This reflects that while academic advancement is important, it is perceived to be less critical compared to other aspects such as using modern teaching methods. In addition, the overall mean score of 3.46 with a standard deviation of 0.94 suggests that the general performance of vocational education teachers is moderate. This indicates that while there are areas of strength, such as the adoption of modern teaching methods, there are also areas that require improvement, such as providing opportunities for teachers' academic advancement. The range of mean values between high and moderate levels underscores the varying impact of digital transformation and digital leadership on different facets of teacher performance. The detailed analysis of mean scores and standard deviations provides valuable insights into specific areas where digital transformation and leadership can be leveraged to improve teacher performance. The high importance placed on modern teaching methods highlights the need for continuous professional development and support in integrating technology into teaching practices. Conversely, the lower scores in areas related to academic advancement suggest a need for more structured support and opportunities for teachers to further their education and specialization. However, this comprehensive analysis not only identifies key areas of strength and improvement but also provides a roadmap for targeted interventions to enhance the overall effectiveness of vocational education teachers in Irbid Governorate. By focusing on the areas identified as having the greatest impact, educational leaders can develop strategies to support teachers in adopting digital tools and methodologies, ultimately leading to improved educational outcomes.

To determine if there are statistically significant differences at the level ($\alpha \leq 0.05$) in the impact of digital transformation on the performance of vocational education teachers in public schools due to variables (gender, academic qualification, years of experience), a multivariate analysis of variance (MANOVA) was conducted. The results are presented in *Table 3,* and *Table 4* as follows.

Table 3: MANOVA Results for Differences in Mean Scores of Study Sample Responses Based on Study Variables

Variable	Level	Impact of Digital Transformation on Teacher Performance	Overall Scale Mean
Gender	Male	Mean = 3.85	Mean = 3.38
		SD = 0.58	SD = 0.42
	Female	Mean = 3.15	Mean = 3.19
		SD = 0.83	SD = 0.71
Academic Qualification	Bachelor's Degree	Mean = 3.43	Mean = 3.59
		SD = 0.84	SD = 0.78
	Postgraduate	Mean = 3.38	Mean = 3.31
		SD = 0.71	SD = 0.66
Years of Experience	Less than 5 years	Mean = 3.33	Mean = 3.68
		SD = 0.92	SD = 0.90
	5 to 10 years	Mean = 3.44	Mean = 3.73
		SD = 0.63	SD = 0.58
	More than 10 years	Mean = 3.18	Mean = 3.23
		SD = 0.92	SD = 0.65

Table 4: MANOVA Results for Differences in Mean Scores of Study Sample Responses Based on Study Variables

Source of Variance	Dimension	Sum of Squares	Degrees of Freedom	Mean Square	F Value	Significance Level
Gender	Impact of Digital Transformation on Teacher Performance	1.352	1	1.354	2.159	0.136
Academic Qualification	Impact of Digital Transformation on Teacher Performance	3.614	1	3.728	6.256	0.014*
Years of Experience	Impact of Digital Transformation on Teacher Performance	2.21	2	1.008	1.0304	0.006*
Error	Impact of Digital Transformation on Teacher Performance	144.012	105	0.521		
Total	Impact of Digital Transformation on Teacher Performance	3365.161	105			
Total	Overall Scale Mean	3192.121	105			
*Statistically significant at the level ($\alpha \leq 0.05$).						

The multivariate analysis of variance (MANOVA) results provide significant insights into the differential impact of digital transformation on the performance of vocational education teachers based on various demographic variables. The analysis revealed that gender did not show statistically significant differences in the impact of digital transformation on teacher performance. The F value was 2.159 with a significance level of 0.136, indicating that male and female teachers are similarly affected by digital transformation initiatives in terms of their performance. This finding aligns with previous studies suggesting that gender does not play a pivotal role in the effectiveness of digital integration in educational settings (Vial, 2019). In contrast, academic qualification was found to have a statistically significant impact on teacher performance in the context of digital transformation. The F value for academic qualification was 6.256, with a significance level of 0.014. This indicates that teachers with different academic qualifications respond differently to digital transformation efforts. Teachers with higher academic qualifications, such as postgraduate degrees, may have more exposure to advanced pedagogical techniques and a better understanding of integrating technology into their teaching practices. This result underscores the importance of advanced education and continuous professional development in enhancing teachers' ability to effectively utilize digital tools (Truong and Diep, 2023). Similarly, years of experience also showed statistically significant differences in the impact of digital transformation on teacher performance, with an F value of 1.0304 and a significance level of 0.006. This finding suggests that more experienced teachers might either benefit more from digital transformation due to their familiarity with various teaching methods or struggle more due to potential resistance to changing long-established practices. It highlights the complex relationship between experience and adaptability to new technologies. Experienced teachers might have developed extensive pedagogical strategies that they can enhance with digital tools, but they may also

require targeted support to overcome any resistance to adopting new technologies (Abu Khairan and Rantisi, 2023). While gender did not significantly affect the impact of digital transformation on the performance of vocational education teachers, both academic qualification and years of experience did show significant differences. This suggests that teachers' academic backgrounds and professional experience levels are crucial factors in determining how effectively digital transformation impacts their performance. These findings emphasize the need for tailored professional development programs that address the specific needs of teachers based on their academic qualifications and experience levels to maximize the benefits of digital transformation in education (Lanzolla et al., 2020).

The results indicate statistically significant differences in the impact of digital transformation on the performance of vocational education teachers based on years of experience and academic qualifications, with significance values of 0.006 and 0.014, respectively. However, there were no statistically significant differences attributed to gender, with a significance value of 0.136. This finding suggests that while gender does not influence how digital transformation affects teacher performance, the level of academic qualification and years of experience do play crucial roles. Supporting this, Razak et al. (2023) emphasize the importance of digital transformation and educational technology communities, particularly for policymakers who need to devise strategies and reconsider existing practices to achieve sustainable education and effective teacher performance. This perspective aligns with the study's findings, highlighting the necessity for tailored approaches in implementing digital transformation that consider teachers' educational backgrounds and professional experience. Additionally, Mohamed (2023) identifies key requirements for the successful application of digital transformation in educational institutions. These include updating educational laws and regulations to align with digital transformation, re-engineering institutional structures and processes to meet the demands of digital integration, providing robust ICT infrastructure, preparing and qualifying educational human resources, and offering continuous learning and self-learning programs in digital technology. Furthermore, fostering the exchange of experiences and enhancing partnerships with the local community are essential. These recommendations underscore the multifaceted approach needed to support teachers effectively during digital transformation, ensuring they have the necessary tools and environment to succeed.

Carvalho et al. (2022) also contribute to this discussion by pointing out that the most discussed aspects of digital transformation involve online learning systems and various types of technology. This focus reflects the practical challenges and opportunities that come with integrating digital tools into educational practices. The findings from Carvalho et al. suggest that for digital transformation to be effective, it must be supported by comprehensive and well-implemented technological systems that teachers can utilize to enhance their instructional methods. Thus, the significant differences based on academic qualifications and years of experience highlight the need for differentiated support and professional development tailored to these factors. While gender does not appear to influence the effectiveness of digital transformation, the varying impacts based on experience and education level indicate that a one-size-fits-all approach is insufficient. Effective digital transformation in education requires strategic planning, robust infrastructure, continuous professional development, and community engagement, as supported by the findings of Razak et al. (2023), Mohamed (2023), and Carvalho et al. (2022). In addition, to test the hypothesis, hierarchical regression analysis was conducted to understand the role digital leadership plays in enhancing the impact of digital transformation on the performance of vocational education teachers. This analysis was performed in two stages. In the first stage, the independent variable (digital transformation) was introduced to control for and adjust it in the regression model. In the second stage, the variable of digital leadership was added to the model to determine its capacity to improve the effect. In *Table 5* below are the summary of the results.

Table 5: Hierarchical Regression Analysis

Independent Variable	Model 1			Model 2		
	Beta	T	sig	Beta	T	sig
Digital Transformation	0.188	2.714	0.017	0.017	0.215	0.002
Digital Leadership				0.787	2.849	0.018
R		7.84		0.910		
R square		0.660		0.870		
Change R				0.063		
F change		152.234		211.825		
Sig		0.000		0.000		

The hierarchical regression analysis involved two models. In the first model, the independent variable (digital transformation) was introduced to control its influence on the dependent variable (teacher performance). The results of the first model showed a very high overall correlation coefficient (R) of 0.847 between digital transformation and teacher performance. This model indicated a statistically significant effect of digital transformation on the performance of vocational education teachers, supported by an F value of 152.234 with a significance level of 0.000. The R Square value of 0.66 suggests that 66% of the variance in teacher performance can be explained by the variance in digital transformation. In the second model, digital leadership was added to the regression model to determine its role in enhancing the effect of digital transformation on teacher performance. The results from the second model revealed a statistically significant impact of digital transformation on teacher performance, with the correlation coefficient increasing to 0.91, representing a 7% increase due to the inclusion of digital leadership. This indicates that digital leadership significantly enhances the relationship between digital transformation and teacher performance. The R Square change value of 0.87, which is statistically significant, shows a 21% increase compared to the first model, highlighting the substantial contribution of digital leadership to improving the positive impact of digital transformation on teacher performance. These findings are consistent with previous studies. For instance, Na'imi and Hattamleh (2023) found a high role of digital leadership in developing teacher performance in educational directorates, with significant impacts noted in areas such as excellence in professional practice and digital culture and learning. Similarly, Abuajwa et al. (2023) reported a positive effect of digital leadership on readiness for change in educational institutions, underscoring the importance of leadership in facilitating digital transformation. However, the hierarchical regression analysis demonstrates that digital leadership significantly enhances the positive impact of digital transformation on the performance of vocational education teachers. This underscores the critical role of digital leadership in educational settings, emphasizing the need for strong leadership to support and guide the integration of digital technologies in teaching practices. The results are backed by empirical evidence from previous studies, reinforcing the importance of digital leadership in achieving effective and sustainable digital transformation in education.

Digital transformation has the potential to enhance the quality of education and fundamentally change how teaching and learning are conducted. According to the current study, the digital transformation of vocational education can improve the quality of education by updating the content and outcomes of graduate training and enhancing relationships among participants in the educational environment. The study posits that the role of digital leadership in the impact of digital transformation on the performance of vocational education teachers is a fascinating area of research that warrants further exploration. Moreover, the study recommends bolstering teachers' efforts and encouraging them through effective management. It emphasizes the importance of developing teachers' competencies and providing a conducive classroom environment. Teachers should be encouraged and given opportunities to pursue academic studies that qualify them further in their field of specialization. This recommendation aligns with findings from Razak et al. (2023), which highlighted the critical role of continuous professional development and strategic policy-making in achieving sustainable education and effective teaching performance. Furthermore, the study underscores the need to activate the role of digital leadership by leveraging technology and investing in digitalization to enhance teachers' performance. This finding is supported by Mohamed (2023), who identified key requirements for successful digital transformation in educational institutions, including updating laws and regulations, re-engineering institutional structures, and providing robust ICT infrastructure. Effective digital leadership, as noted by Carvalho et al. (2022), is crucial in navigating these changes and ensuring that the integration of online learning systems and various technologies leads to improved educational outcomes. However, digital transformation holds considerable promise for improving vocational education by modernizing educational content and fostering better relationships within the educational ecosystem. The critical role of digital leadership in this process cannot be overstated. By encouraging and supporting teachers, providing ongoing professional development, and leveraging digital technologies, educational institutions can significantly enhance teacher performance and overall educational quality. Future research should continue to explore this dynamic interplay between digital transformation and digital leadership to uncover more insights and best practices.

6. Implication

The findings of this study have several important implications for educational policy, practice, and future research. Firstly, the significant role of digital leadership in enhancing the impact of digital transformation on teacher performance underscores the need for strong and effective leadership in educational institutions. Policymakers should focus on developing and implementing leadership training programs that equip school leaders with the necessary skills to manage and promote digital transformation effectively. Secondly, the study highlights the necessity of continuous professional development for teachers, particularly in the context of digital transformation. Educational institutions should provide ongoing training and support to help teachers integrate digital tools into their teaching practices. This support should be tailored to teachers' academic qualifications and years of experience to address their specific needs and challenges. Thirdly, the substantial increase in the positive impact of digital transformation on teacher performance, facilitated by digital leadership, suggests that schools should prioritize investments in digital infrastructure and leadership development. This can include upgrading ICT infrastructure, providing access to advanced digital tools, and fostering a culture of innovation and continuous learning among teachers. Finally, future research should explore the specific mechanisms through which digital leadership influences the effectiveness of digital transformation. Understanding these mechanisms can help in designing more targeted interventions and strategies to maximize the benefits of digital transformation in education.

7. Conclusion

This paper demonstrates that digital leadership plays a crucial role in enhancing the impact of digital transformation on the performance of vocational education teachers. While gender did not significantly affect this relationship, both academic qualifications and years of experience were found to be significant factors. The hierarchical regression analysis revealed that the inclusion of digital leadership significantly improved the positive effects of digital transformation on teacher performance, highlighting the importance of strong leadership in educational settings. However, the results of this study are consistent with previous research, reinforcing the idea that effective digital leadership is essential for successful digital transformation in education. The findings emphasize the need for comprehensive professional development programs, robust digital infrastructure, and strategic leadership to support teachers in integrating digital technologies into their teaching practices. Thus, this study contributes to the growing body of literature on digital transformation and leadership in education, providing valuable insights for policymakers, educators, and researchers. By fostering effective digital leadership and supporting continuous professional development, educational institutions can enhance teacher performance and ultimately improve educational outcomes.

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