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The Impact of Digital Transformation Requirements on the Quality of Banking Services : From the perspective of commercial bank customers in Libya

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A B S T R A C T

This study investigates digital transformation's impact on banking service quality in Libya, a region with limited research. Using survey data from 273 respondents analyzed via AMOS, the findings show that human resource efficiency, security, privacy, and organizational culture significantly influence service quality. However, technological infrastructure and leadership vision have only partial effects. These insights help bank managers and policymakers prioritize the most impactful factors particularly human and cultural elements to improve customer satisfaction. The study also encourages further research in other regions adopting online banking, contributing to a broader understanding of how digital transformation shapes banking services across different contexts.

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INTRODUCTION

Digital transformation has emerged as a pivotal force reshaping the banking sector, driven by rapid technological advancements and changing consumer preferences (Bueno et al., 2024). The emergence of information and communication technologies is believed to have created a qualitative shift in all aspects of human life. Consequently, technology has become an indispensable necessity for society and the business environment, ranging from work automation to the digitization of services (Osei et al., 2023). Digital transformation is considered an optimal solution to the challenges facing banks, and banking digital transformation is implemented through various mechanisms. Some institutions adopt gradual transformation, others implement partial transformation, while some choose full digital transformation (Shanti et al., 2022). Digitally transformed services have particularly influenced customer satisfaction through the use of advanced technologies such as artificial intelligence, the Internet of Things, virtual and augmented reality, cloud computing, and big data analytics (Chin et al., 2023). Rapid developments and changes in financial markets have altered the reality of the banking environment beyond expectations. The rapid pace of technological progress and market liberalization has increased competitive pressures among banks and non-banking institutions. These changes, among others, have had a clear impact on banks due to their nature, as they have increased the magnitude of problems within the banking sector. This situation has intensified the need to focus on the quality of banking services in order to improve bank performance (Al-Habil, 2017). To evaluate service quality, the SERVQUAL model is widely recognized and commonly used. It was developed by Parasuraman and colleagues and consists of five dimensions: tangibility, responsiveness, assurance, reliability, and empathy (Shak et al., 2022). This study specifically aims to determine how digital transformation requirements affect the quality of banking services in Libyan commercial banks from the perspective of their customers, as customer satisfaction reflects their evaluation of the perceived service quality.

THEORETICAL REVIEW

The Concept of Digital Transformation

Digital transformation and big data analytics capabilities enable organizations to adapt to rapidly changing markets, innovate, and maintain their position in the digital era (Butt et al., 2024). the digital divide affects many people worldwide .(Emran et al , 2025) , The term “transformation” implies the ability to take necessary actions when organizations encounter new technologies, and it should not be confused with simple change (Singh & Hess, 2017). Digital transformation is the use of digital technologies to improve the efficiency and effectiveness of processes.) Emran , Elhony , 2023). Digital transformation represents a change in the activities of individuals and organizations through the application of digital technologies to achieve significant improvements in business processes, personal experiences, and new business models (Abdulquadri et al., 2021). A more specific definition describes digital transformation as a process aimed at improving an entity by making fundamental changes to its characteristics through a combination of information,

computing, communication, and connectivity technologies (Vial, 2019). Digital transformation has profound effects on institutions across various sectors . (Emran , Elhony , 2025). Digital transformation is also considered a process for enhancing competitive advantages (Reis et al., 2020). The main elements of digital transformation include technology, human competencies (skills), and appropriate strategies for the stage of organizational development. Therefore, organizations undergoing digital transformation require a clear strategy, a proper methodology, and suitable competencies to establish an effective digital transformation system, promote systematic transformation and change, and expand the pace of innovation within continuous development (Teng et al., 2022). Consequently, digital transformation has become essential for enhancing organizational performance in today's competitive business environment. In addition to the use of digital technologies, digital transformation involves developing new applications, migrating to cloud computing, or integrating artificial intelligence and machine learning. This reflects the strategic utilization of resources and capabilities to strengthen organizations and redefine the value propositions they offer to their customers (Gong & Ribiere, 2021).

Digital Transformation Requirements

Strategic Vision of Leaders

Digital transformation also requires a clear strategic vision .(Emran et al , 2025) Leadership is not a unidirectional concept; rather, it is a relationship based on exchange between the leader and other parties, such as employees or other stakeholders (Simon, 2020). In the context of digital transformation, leaders must possess a clear strategic vision for the future of their organizations and be capable of determining how technology can be used to expand business operations. Digital transformation is considered successful when the overall objectives of the organization are achieved. Likewise, people tend to accept technological advancement only when they understand its relevance to their tasks. Senior managers, in particular, bear a significant responsibility for managing strategic alignment and promoting the dissemination of a digital culture (Cortellazzo et al., 2019).

Technological Infrastructure

Technologies are increasingly integrated into teaching, learning, and administration. (Emran & Elhony, 2024)With the increasing volume of generated data, the need to analyze, process, and interpret this data is also growing (Ngildsen & Olsson, 2016). Digital technologies can support organizations in leveraging their existing core competencies or in developing potential competencies to gain a competitive advantage. Due to the application of digital technologies, digital transformation is closely linked to strategic changes in business models (Sebastian et al., 2020). Therefore, the issue extends beyond technical efficiency to include organizational capabilities and readiness, as the use of big data may require changes in roles, routines, and decision-making processes within the organization (Liliane et al., 2021). Consequently, a strong technological infrastructure is essential to enable digital strategies.

Organizational Culture

Digital technology integrates the real world with the virtual world to provide a continuous and unique work experience (Liu et al., 2025). A well-established digital transformation culture throughout the organization may indicate not only readiness but also the expertise required to integrate data into planning processes and internal decision-making. Civil service employees can benefit from institutional support for their potential interest in digital transformation through training or through data exchange among government departments (Giest, 2017).

Human Resource Competence

Human resources are among the most significant factors influencing organizations' adoption of data usage practices, particularly in the context of big data (Liliane et al., 2021). Digital transformation in human resource management contributes to saving time and increasing the productivity of HR functions (Mosca, 2020). Therefore, the availability of qualified personnel in information technology and data science expertise is crucial for organizations in developing strategies for data utilization. Human capital factors, such as the number of employees or the presence of specialized staff, are particularly important for radical innovations that involve fundamental changes and require a substantial amount of new knowledge (Liliane et al., 2021).

Security and Privacy

Digital security risks have become a significant challenge and are no longer merely a technological issue. They must be managed in an integrated and balanced manner to achieve sustainable long-term benefits. Therefore, a structured approach must be adopted to ensure information security for both internal and external stakeholders (Abbas, 2021). Establishing a foundation for security measures to protect confidential data and reduce the likelihood of breaches represents the primary objective of security compliance. It is important to distinguish between security compliance and broader cybersecurity strategies. While compliance focuses on meeting specific regulatory requirements, cybersecurity strategies encompass a more comprehensive approach to protecting information systems from various cyber threats (Hamdani et al., 2021). Cybersecurity strategies may include risk management, incident response planning, threat intelligence, and continuous monitoring, all of which are essential components of a proactive security posture. Security compliance serves as the foundation for cybersecurity efforts, ensuring that organizations implement the necessary controls to protect sensitive data and fulfill legal obligations (Taherdoost, 2022).

Service Quality in Banking

The use of technology in delivering banking services has increased significantly, as it is employed to reduce costs and mitigate risks. Banking service quality refers to the standardized services produced by employees to meet customers' needs and expectations (Kirnan et al., 2025). Service quality undoubtedly leads to customer satisfaction. To achieve a high level of customer

satisfaction, most researchers suggest that service providers should deliver a high level of service quality, as service quality is generally considered a key determinant of customer satisfaction. As service quality improves, the likelihood of customer satisfaction increases. However, quality represents only one dimension among several dimensions upon which satisfaction is built; similarly, satisfaction may also influence future perceptions of service quality (Shanka, 2012). The present study adopts the modified version of the service quality dimensions from the SERVQUAL model (Parasuraman et al., 1991). Tangibles refer to the physical facilities and the appearance of employees; reliability refers to the ability to perform the promised service dependably; responsiveness refers to the promptness of service delivery to customers; assurance refers to employees' knowledge and their ability to build customer trust and confidence; and finally, empathy refers to the care and individualized attention provided by employees (Ueltschy et al., 2007; Parasuraman et al., 1988).

METHODOLOGY

Empirical Section

Multicollinearity

The multicollinearity test was conducted to verify that the correlations among the independent variables do not exceed 0.80 (Sekaran & Bougie, 2016). The absence of high correlations among the independent variables can also be examined using the Variance Inflation Factor (VIF), where the values should not exceed 5.00, and tolerance levels should be greater than 0.20 (Hair et al., 2010). By applying the Variance Inflation Factor method, the analysis results showed that the VIF values were less than 2 and that tolerance levels exceeded 0.20. Therefore, there is no evidence supporting the existence of a multicollinearity problem among the independent variables of the study.

Measurement Model

The measurement model aims to assess the construct validity of the study measures. Construct validity includes convergent validity and discriminant validity. Convergent validity refers to the strength of the relationship between the scale items and the scale itself, whereas discriminant validity refers to the weak relationship between the items of one scale and those of a different scale. Figure (1) presents the measurement model. The measurement model presented in Figure (1) revealed model fit indices that correspond appropriately with the items as follows: the chi-square index (χ^2) recorded a value of 524.6 with degrees of freedom (df = 356) and a significance level (p = .000). The normed chi-square (χ^2/df) = 1.47 (less than 3). The Root Mean Square Error of Approximation (RMSEA) = .044 (less than .08). The Comparative Fit Index (CFI) = .974. The Tucker–Lewis Index (TLI) = .96. The Incremental Fit Index (IFI) = .95 (greater than .90).

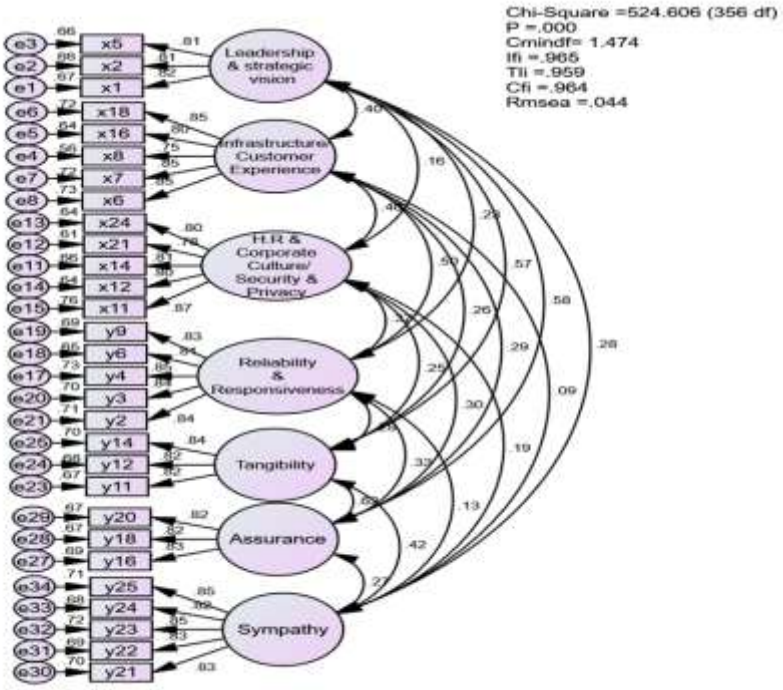

Figure 1. The Measurement Model

Convergent Validity

One of the conditions for achieving convergent validity is that the Average Variance Extracted (AVE) should be greater than 0.50, and the Composite Reliability (CR) should exceed 0.60 (Awang, 2015). Table 1 presents the results, indicating that the conditions for convergent validity were met.

Table 1. Evidence of Convergent Validity for Study Variables

Latent Construct	**Item**	**Loadings**	**Standard Error**	**Composite Reliability (CR)**	**Average Variance Extracted (AVE)**
Leadership Strategic Vision	1x	82.	85.	67.	66.
	2x	81.		66.	
	5x	81.		66.	
Technology Infrastructure – Customer Experience	6x	85.	91.	72.	67.
	7x	85.		64.	
	8x	75.		56.	
	16x	80.		72.	
	18x	85.		73.	
Human Resource Competence, Organizational Culture, and	11x	87.	90.	76.	66.
	12x	80.		64.	
	14x	81.		66.	
	21x	78.		61.	
	24x	80.		64.	

Security & Privacy					
Reliability – Responsiveness	2y	84.	92.	71.	69.
	3y	84.		70.	
	4y	85.		73.	
	6y	81.		65.	
	9y	83.		69.	
Tangibles	11y	82.	86.	67.	68.
	12y	82.		68.	
	14y	84.		70.	
Security	y16	83.	86.	69.	67.
	y18	82.		67.	
	y20	82.		67.	
Empathy	21y	83.	92.	70.	70.
	22y	83.		69.	
	23y	85.		72.	
	24y	82.		68.	
	25y	85		71.	

Discriminant Validity

A latent variable is considered to achieve discriminant validity when two main conditions are met: 1) the Fornell-Larcker criterion, which requires that the square root of the AVE of each construct is greater than the shared variance (correlation) with other constructs, and 2) the composite reliability is greater than the shared variance (Awang, 2015). Table 2 summarizes the discriminant validity results.

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Table 2. Discriminant Validity Using the Fornell-Larcker Criterion

Latent Construct	Leadership Strategic Vision	Technology Infrastructure – Customer Experience	Human Resources, Organizational Culture – Security & Privacy	Reliability – Responsiveness	Tangibles	Security	Empathy
Leadership Strategic Vision	81.						
Technology Infrastructure – Customer Experience	40.	82.					

Human Resources, Organizational Culture – Security & Privacy	16.	40.	81.				
Reliability – Responsiveness	23.	50.	27.	83.			
Tangibles	57.	26.	25.	28.	83.		
Security	58.	29.	30.	33.	63.	82.	
Empathy	28.	.09	19.	13.	42.	27.	84.

The diagonal values (0.81, 0.82, 0.81, 0.83, 0.82, 0.82, 0.845) represent the square roots of the Average Variance Extracted (AVE) and are greater than the correlation coefficients (shared variance) between latent constructs. Therefore, discriminant validity is established.

Structural Equation Modeling (Hypotheses Testing)

In order to test the research hypotheses, the researchers conducted structural equation modeling (SEM) using AMOS. Since the multivariate data did not follow a normal distribution, bootstrap analysis was employed to obtain reliable results. Figure 2 illustrates the structural model for the study. For model fit in the bootstrap analysis, a sample size of 2,000 was selected. The results indicated good model fit for 1,927 out of 2,000 bootstrap samples, while 73 samples failed to fit in 104 bootstrap iterations. The Bollen-Stine significance test yielded a value of 0.37, which is below the conventional significance level of 0.05, suggesting that the model does not exhibit perfect fit (Bollen & Stine, 1992). However, relying on a single fit index is insufficient. Additional fit indices, shown in Figure 11, confirmed the model's quality. The standardized chi-square (χ^2/df) was 1.63, which is considered very good as it is below 2 (Hair, Black, Babin, & Anderson, 2010). Both the Comparative Fit Index (CFI) and the Incremental Fit Index (IFI) were approximately 0.95, while the Tucker-Lewis Index (TLI) reached 0.94. The Root Mean Square Error of Approximation (RMSEA) was 0.05. These values indicate strong relationships among the study constructs (Hair, Hult, Ringle, & Sarstedt, 2017).

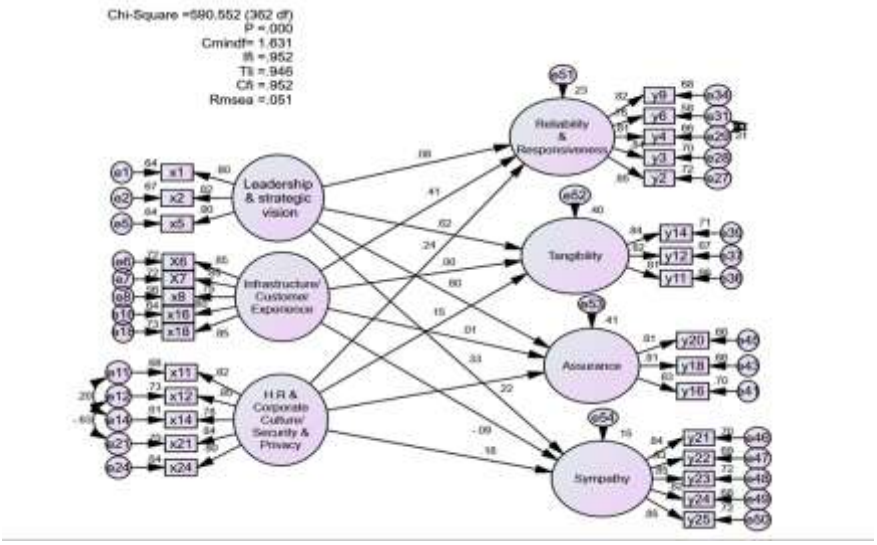

Figure 3. Structural Equation Modeling (SEM)

Table 3. Structural Model Estimates of Relationships

Independent Latent Construct	Path	Dependent Latent Construct	Estimate (β)	Standard Error (SE)	P-value
Leadership & Strategic Vision	→	Reliability – Responsiveness	0.08	0.073	0.271
Leadership & Strategic Vision	→	Tangibles	0.62	0.086	0.001
Leadership & Strategic Vision	→	Security	0.60	0.081	0.001
Leadership & Strategic Vision	→	Empathy	0.33	0.071	0.001
Technology Infrastructure – Customer Experience	→	Reliability – Responsiveness	0.41	0.073	0.001
Technology Infrastructure – Customer Experience	→	Tangibles	0.00	0.073	0.993
Technology Infrastructure – Customer Experience	→	Security	0.01	0.076	0.842
Technology Infrastructure – Customer Experience	→	Empathy	-0.09	0.082	0.292

Human Resources & Organizational Culture – Security & Privacy	→	Reliability – Responsiveness	0.24	0.072	0.002
Human Resources & Organizational Culture – Security & Privacy	→	Tangibles	0.15	0.069	0.023
Human Resources & Organizational Culture – Security & Privacy	→	Security	0.22	0.063	0.002
Human Resources & Organizational Culture – Security & Privacy	→	Empathy	0.18	0.079	0.045

RESULTS AND DISCUSSION

The bootstrap test results presented in Table 3 support 8 out of 12 hypotheses. Specifically:

1. Leadership & Strategic Vision positively affects Tangibles ($\beta = 0.62$, $P < 0.05$), Security ($\beta = 0.60$, $P < 0.05$), and Empathy ($\beta = 0.33$, $P < 0.05$). This indicates that for each one-unit increase in leadership strategic vision, tangibles, security, and empathy increase by 62%, 60%, and 33%, respectively, all statistically significant. However, leadership strategic vision does not significantly affect Reliability – Responsiveness ($\beta = 0.08$, $P > 0.05$), indicating a very weak and non-significant effect. Standard errors for leadership strategic vision on service quality dimensions (0.073, 0.086, 0.081) are low, suggesting that these estimates are precise.
2. Technology Infrastructure – Customer Experience positively affects Reliability – Responsiveness ($\beta = 0.41$, $P < 0.05$). This indicates that a one-unit increase in technology infrastructure and customer experience increases reliability-responsiveness by 41%, with a small standard error (0.073), confirming precise estimation. Conversely, no significant effects were observed for tangibles, security, or empathy ($P > 0.05$).
3. Human Resources & Organizational Culture – Security & Privacy positively influences all service quality dimensions: reliability – responsiveness ($\beta = 0.24$, $P < 0.05$), tangibles ($\beta = 0.15$, $P < 0.05$), security ($\beta = 0.22$, $P < 0.05$), and empathy ($\beta = 0.18$, $P < 0.05$). Standard errors range from 0.063 to 0.079, indicating precise estimates.

Moreover, explanatory power of digital transformation dimensions varies across service quality outcomes:

a) Security exhibits the highest explained variance (41%), leaving 59% attributable to unexamined factors.
b) Tangibles have 40% variance explained, with 60% unexplained.
c) Reliability – Responsiveness is 23% explained by the predictors, leaving 77% unexplained.
d) Empathy shows the lowest explained variance at 15%, with 85% due to factors outside the current study.

These findings highlight that certain digital transformation dimensions (especially leadership vision and HR & organizational culture – security & privacy) play critical roles in improving specific aspects of banking service quality.

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DISCUSSION

Digital transformation presents both opportunities and challenges for the banking sector. Early adoption of digital transformation can provide competitive advantages, whereas slow adoption may result in missed opportunities. This study explored the impact of digital transformation requirements on service quality in the banking sector. The main conclusion of this study is that digital transformation requirements play a pivotal role in enhancing banking service quality in Libyan commercial banks. The results partially align with previous studies. For instance, Al-Kahtani et al. (2024) and Alayoubi et al. (2020) reported that leadership strategic vision significantly influences all dimensions of service quality. In contrast, the present study found that leadership strategic vision positively affects tangibles, security, and empathy but has little to no effect on reliability – responsiveness. This discrepancy may be explained by ambiguities in strategic vision, insufficient clarity for customers, and low communication levels between leaders, employees, and customers. A clear and well-defined leadership strategic vision is a fundamental driver for improving service quality in banks, as it reinforces senior management commitment and directs resources effectively to meet customer requirements. The study also revealed that technology infrastructure and customer experience positively influence the reliability – responsiveness dimension of service quality. Quick responsiveness indicates the bank's readiness to support customers and provide prompt service. These findings partially align with Silalahi et al. (2024) and Wali (2013), who found a significant effect of technology infrastructure on all service quality dimensions. Reliability and responsiveness are therefore essential pillars of modern technology infrastructure and enhanced customer experience. The lower impact observed on tangibles may be attributed to customers' reduced reliance on physical facilities and direct interaction with employees in the context of electronic services. Similarly, the smaller effect on security could indicate that customers are increasingly willing to accept some risk with greater technology reliance. Finally, the reduced effect on empathy may reflect changes in customer interaction patterns, which now occur through technology-mediated channels. Differences in these results may also be influenced by rapid technological advancements that

significantly affect business performance. Regarding organizational culture, the results are consistent with prior research, showing a positive effect on all service quality dimensions. Organizational culture strengthens the positive relationship between empathy, reliability, tangibles, and customer satisfaction (Famiyeh et al., 2018; Zakari & Poku, 2013; Metz et al., 2020). Likewise, human resource competence positively influences all service quality dimensions, as HR practices directly affect service quality through effective recruitment, continuous training, and employee motivation. Well-trained and satisfied employees contribute to higher service performance, making human resources a key pillar for achieving service quality (Haynes & Fryer, 2000; Chand, 2010; Papademetriou et al., 2023; Xu & Kefeng, 2016). These results are also in agreement with Casaló et al. (2007), Li et al. (2021), and Arcand et al. (2017). Concerning website security, privacy, and usability, these factors directly and significantly affect service quality and enhance customer satisfaction. Maintaining operational safety, confidentiality, and reliability heavily depends on data privacy and security. Strong data protection is essential to safeguard customer information from misuse or unauthorized access, consistent with Wang et al. (2024). Finally, the study suggests that applying the Technology Acceptance Model (TAM) can help understand how users adopt new technologies and can be utilized to improve technology design, user training, and technology marketing strategies. Here is a formal academic English translation of your Recommendations, Future Research, and Acknowledgments section, revised for grammar, clarity, and scholarly style while preserving the original meaning:

CONCLUSIONS AND RECOMMENDATIONS

This study concludes that digital transformation plays a vital role in improving banking service quality in Libyan commercial banks. Among the five digital transformation dimensions examined, human resource competence, security and privacy, and organizational culture have a significant impact on banking service quality. Meanwhile, technological infrastructure and leadership's strategic vision only partially affect certain dimensions. Interestingly, security is the dimension most influenced by digital transformation, with 41% variance explained, followed by tangibles at 40%, while empathy accounts for only 15%. This indicates that customers focus more on security aspects and physical evidence of services rather than personal interaction in digital services. This research helps bank managers and policymakers prioritize the most impactful factors on customer satisfaction, particularly human resources and organizational culture, to retain existing customers and attract new ones in the digital era.

Based on the findings, this study recommends that bank managers and policymakers in Libya focus on strengthening human resource competence through continuous training and development programs to enhance digital skills. Banks should also prioritize improving security and privacy measures to build customer trust in digital banking services. Fostering a digital-friendly organizational culture is essential to support innovation and service excellence. While technological infrastructure remains important, investments should be aligned with customer needs and expectations. Additionally, bank leaders need to communicate their strategic vision more clearly to employees and customers

to ensure alignment between digital transformation goals and service delivery. By focusing on these key areas, banks can improve service quality, increase customer satisfaction, retain existing clients, and attract new customers in an increasingly competitive digital landscape.

FURTHER STUDY

Future studies should expand on this research by investigating the impact of artificial intelligence applications on customer satisfaction, examining how virtual digital banks affect organizational structure, and exploring the relationship between cybersecurity, user experience, and customer loyalty. Researchers could also analyze digital transformation's role in financial inclusion, its effects on human resource strategies in banks, and replicate this study across other sectors like education or healthcare. Comparative studies across different countries and regions experiencing rapid adoption of online banking services would also help test the broader applicability of these findings and provide deeper insights into how digital transformation shapes service quality across various contexts.

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