JPB REVIEW
INTERNATIONAL JOURNAL OF PROFESSIONAL BUSINESS REVIEW
ISSN: 2525-3654
OPEN ACCESS

THE IMPACT OF INFORMATION TECHNOLOGY ON FINANCIAL INCLUSION: A STUDY ON A SAMPLE OF COMMERCIAL BANKS IN BATNA PROVINCE, ALGERIA

Ghada Timedjeghdine [A], Asma Djarmouni[B]

ARTICLE INFO

Article history:

Received: Feb, 7th 2025

Accepted: Apr, 9th 2025

Keywords:

Financial Inclusion;
Information Technology;
Digital Banking;
Sustainability.

ABSTRACT

Objective: This study aims to examine the impact of information technology on financial inclusion, focusing on tools such as mobile applications, digital wallets, and online payment systems. The primary objective is to assess the extent to which these technologies enhance access to financial services.

Theoretical Framework: The study is grounded in the concepts of financial inclusion and digital transformation in the banking sector. It draws upon theories of technological innovation and technology adoption, alongside prior research that emphasizes the role of digital tools in expanding financial access, particularly in developing regions.

Method: A quantitative approach was employed. A structured questionnaire was distributed to a random sample of 50 employees from commercial banks in Batna Province, Algeria, with 43 valid responses collected (response rate: 86%). Data were analyzed using SPSS version 26, incorporating descriptive statistics, Cronbach's alpha for reliability, correlation analysis, normality testing, and multiple linear regression.

Results and Discussion: The findings indicate a significant and positive effect of online payment systems on financial inclusion, which emerged as the most influential factor. Although mobile applications and digital wallets also showed positive correlations with financial inclusion, their effects were not statistically significant in the regression model. These results suggest the need to address challenges such as adoption barriers and usability issues to fully realize the potential of these tools.

Research Implications: The study provides practical and theoretical insights into how digital technologies can enhance financial inclusion within the regional banking sector. It highlights the need for improved digital infrastructure and user engagement to optimize the impact of technological tools.

Originality/Value: This research fills a contextual gap by offering empirical evidence from Algeria on the relationship between information technology and financial inclusion. It contributes to the literature by emphasizing the central role of online payment systems and offers actionable recommendations for banking institutions aiming to advance inclusive finance through digital innovation.

Doi: https://doi.org/10.26668/businessreview/2025.v10i5.5457

[A] *PhD in Accounting. Faculty of Economics Commerce and Management Sciences, Innovation and Financial Engineering Laboratory.Oum El Bouaghi University, Algeria.*
E-mail: ghada.timedjeghdine@univ-oeb.dz Orcid: https://orcid.org/0009-0001-5710-2396
[B] *Lecturer A. Faculty of Economics Commerce and Management Sciences, Ferhat Abbas Sétif University 1, Algeria. E-mail: asma.djarmouni@univ-setif.dz Orcid: https://orcid.org/0000-0003-3480-8465*

O IMPACTO DA TECNOLOGIA DA INFORMAÇÃO NA INCLUSÃO FINANCEIRA: UM ESTUDO COM UMA AMOSTRA DE BANCOS COMERCIAIS NA PROVÍNCIA DE BATNA, ARGÉLIA

RESUMO

Objetivo: Este estudo tem como objetivo analisar o impacto da tecnologia da informação sobre a inclusão financeira, com foco em ferramentas como aplicativos móveis, carteiras digitais e sistemas de pagamento online. A finalidade principal é avaliar em que medida essas tecnologias contribuem para o acesso ampliado aos serviços financeiros.

Referencial Teórico: A pesquisa fundamenta-se nos conceitos de inclusão financeira e transformação digital no setor bancário, baseando-se em teorias de inovação tecnológica e adoção de tecnologia. Também considera estudos anteriores que destacam o papel das ferramentas digitais na ampliação do acesso financeiro, especialmente em regiões em desenvolvimento.

Método: Adotou-se uma abordagem quantitativa. Um questionário estruturado foi distribuído a uma amostra aleatória de 50 funcionários de bancos comerciais na província de Batna, Argélia, sendo obtidas 43 respostas válidas (taxa de resposta: 86%). Os dados foram analisados por meio do software SPSS versão 26, utilizando estatísticas descritivas, teste alfa de Cronbach para confiabilidade, análise de correlação, teste de normalidade e regressão linear múltipla.

Resultados e Discussão: Os resultados demonstraram um impacto positivo e estatisticamente significativo dos sistemas de pagamento online sobre a inclusão financeira, sendo esse o fator mais influente. Embora os aplicativos móveis e as carteiras digitais também tenham mostrado correlações positivas com a inclusão financeira, seus efeitos não foram estatisticamente significativos na análise de regressão. Esses achados sugerem que o potencial dessas ferramentas pode ser limitado por barreiras como dificuldades de adoção, problemas de usabilidade ou infraestrutura tecnológica deficiente.

Implicações da Pesquisa: A pesquisa oferece contribuições práticas e teóricas ao demonstrar como as tecnologias digitais podem promover a inclusão financeira no setor bancário regional. Enfatiza-se a necessidade de fortalecer a infraestrutura digital e incentivar o uso efetivo dessas ferramentas para maximizar seus benefícios.

Originalidade/Valor: Este estudo preenche uma lacuna contextual ao apresentar evidências empíricas sobre a relação entre tecnologia da informação e inclusão financeira na Argélia. A pesquisa contribui para a literatura ao destacar o papel central dos sistemas de pagamento online e propõe recomendações práticas para que instituições bancárias impulsionem a inclusão financeira por meio da inovação digital.

Palavras-chave: Inclusão Financeira, Tecnologia da Informação, Banco Digital, Sustentabilidade.

EL IMPACTO DE LA TECNOLOGÍA DE LA INFORMACIÓN EN LA INCLUSIÓN FINANCIERA: UN ESTUDIO EN UNA MUESTRA DE BANCOS COMERCIALES EN LA PROVINCIA DE BATNA, ARGELIA

RESUMEN

Objetivo: El objetivo de este estudio es analizar el impacto de la tecnología de la información en la inclusión financiera, centrándose en herramientas como las aplicaciones móviles, las billeteras digitales y los sistemas de pago en línea. El propósito principal es evaluar hasta qué punto estas tecnologías mejoran el acceso a los servicios financieros.

Marco Teórico: El estudio se fundamenta en los conceptos de inclusión financiera y transformación digital en el sector bancario. Se basa en teorías de innovación tecnológica y adopción de tecnologías, además de investigaciones previas que destacan el papel de las herramientas digitales para ampliar el acceso financiero, especialmente en contextos en desarrollo.

Método: Se utilizó un enfoque cuantitativo. Se distribuyó un cuestionario estructurado a una muestra aleatoria de 50 empleados de bancos comerciales en la provincia de Batna, Argelia, y se obtuvieron 43 respuestas válidas (tasa de respuesta: 86%). Los datos fueron analizados utilizando SPSS versión 26, empleando estadísticas descriptivas, el coeficiente alfa de Cronbach para evaluar la fiabilidad, análisis de correlación, prueba de normalidad y regresión lineal múltiple.

Resultados y Discusión: Los resultados indican un efecto positivo y significativo de los sistemas de pago en línea sobre la inclusión financiera, siendo este el factor más influyente. Aunque las aplicaciones móviles y las billeteras digitales mostraron correlaciones positivas con la inclusión financiera, su efecto no fue estadísticamente significativo en el modelo de regresión. Estos resultados sugieren la necesidad de abordar barreras como la adopción limitada y los problemas de usabilidad para maximizar el potencial de estas herramientas.

Implicaciones de la investigación: El estudio ofrece perspectivas prácticas y teóricas sobre cómo las tecnologías digitales pueden fomentar la inclusión financiera en el sector bancario regional. Resalta la necesidad de mejorar

la infraestructura digital y la participación del usuario para optimizar el impacto de estas herramientas tecnológicas.
Originalidad/Valor: Esta investigación llena un vacío contextual al ofrecer evidência empírica desde Argelia sobre la relación entre la tecnología de la información y la inclusión financiera. Contribuye a la literatura al enfatizar el papel central de los sistemas de pago en línea y ofrece recomendaciones prácticas para que las instituciones bancárias promuevan la inclusión financiera mediante la innovación digital.

Palabras clave: Inclusión Financiera, Tecnología de la Información, Banca Digital, Sostenibilidad.

1 INTRODUCTION

The economic systems of developed countries are increasingly classified as digital economies, driven by the ongoing technological transformation known as Industry 4.0 (Teixeira & Ana Teresa, 2022). In contrast, developing nations are progressively enhancing the role of information technology in their social and economic advancement, gradually integrating digitization into various facets of society (Mursalov, Yarovenko, & vasilyeva, 2023). Information technology (IT) has emerged as a pivotal driver of economic growth and efficiency across sectors, improving automation, enhancing production, and increasing transparency (Brodny & Tutak , 2022).

In the financial sector, the integration of information technology with traditional financial services has led to significant innovations in financial technology. This transformation has not only changed the way financial services are provided but has also contributed to financial inclusion by introducing a variety of new financial products that target a broader segment of society, enabling individuals and small businesses to access financial services more easily (Boot *et al*., 2021).

Promoting financial inclusion is essential for achieving comprehensive and sustainable economic growth (Azmeh, 2019). Recognized as a crucial element in enhancing social conditions, financial inclusion plays a vital role in advancing the Sustainable Development Goals (SDGs) by reducing poverty, promoting equality, and fostering human development (Abdullah & Kazuo , 2020). An inclusive financial system facilitates access to savings services, payment methods, and risk management solutions, enabling unbanked individuals to invest in education, save, and launch businesses, thereby alleviating poverty and driving economic development (Polloni-silva *et al*., 2021).

The significance of financial inclusion in achieving the SDGs and addressing class disparities has been underscored in the context of the United Nations' 2030 Agenda (Khan *et al*., 2021). Many developing and emerging economies have recognized the critical role of

financial inclusion in ensuring financial stability and have actively sought to enhance it as part of their national development strategies (Barajas *et al*., 2020).

Furthermore, information technology, supported by robust telecommunications infrastructure, is instrumental in fostering economic growth by boosting productivity, lowering transaction costs, and driving innovation within the financial sector. The development of IT has had a profound impact on global economic progress, highlighting its potential to shape and sustain long-term economic growth and prosperity (Nchofoung & Asongu, 2022).

The importance of this research stems from its focus on examining the impact of information technology on financial inclusion, specifically within the context of commercial banks in Batna province. This study stands out by providing a detailed assessment of the influence of some technologies: mobile applications, digital wallets, and online payment systems on advancing financial inclusion. By analysing the unique role of each technology, the research offers valuable insights into how these tools can address barriers to financial access and foster inclusive economic development. This contribution is particularly significant as it fills a notable gap in the existing literature, offering a nuanced understanding of the relationship between technological innovation and financial inclusion.

2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 A HISTORICAL OVERVIEW OF FINANCIAL INCLUSION

Financial inclusion is widely recognized as a critical driver of economic growth, poverty alleviation, and social equity. Historically, access to financial services has been constrained, particularly in developing nations, where conventional banking systems have predominantly catered to urban and affluent segments of the population, frequently overlooking rural and low-income communities. Recognizing this disparity, governments and international organizations began prioritizing financial inclusion by the mid-20th century, seeking to extend financial services to marginalized groups (Demirguc-Kunt *et al*., 2018) .The 1990s marked a pivotal shift with the emergence of microfinance, exemplified by institutions like Grameen Bank in Bangladesh, which introduced microloans to individuals excluded from conventional banking (yunus, 2010).Despite these initiatives, financial exclusion persisted in regions with inadequate infrastructure and widespread poverty. However, the advent of digital technologies in the early

21st century, such as mobile phones and internet-based innovations, facilitated the rise of financial technology (FinTech), offering new solutions to enhance financial accessibility.

The term "financial inclusion" first appeared in academic literature through Leyshon and Thrift (1994), who explored the effects of bank closures on financial access in Southeast England. By the late 1990s, the concept had expanded to encompass broader determinants of access to financial services. The World Bank defines financial inclusion as the proportion of individuals and businesses that access and utilize financial services. Conversely, financial exclusion refers to the lack of access to affordable and appropriate financial products and services, which perpetuates social and economic marginalization (Burkett & Sheehan, 2009). Beyond mere access, financial inclusion also emphasizes service utilization and quality, acknowledging that factors such as religion, culture, cost, and regulatory constraints can influence financial engagement (Demirguc-Kunt *et al*., 2018).

The growing recognition of financial inclusion's significance has driven policymakers to integrate it into economic development strategies. Expanding financial services not only reduces poverty but also enhances the productivity of micro, small, and medium enterprises (MSMEs), fosters business formalization, and promotes economic stability. At a macroeconomic level, financial inclusion strengthens monetary policy effectiveness, reduces income inequality, and contributes to overall financial stability. Consequently, both developed and developing nations have intensified efforts to establish policies and regulatory frameworks aimed at building inclusive financial systems.

2.2 INFORMATION TECHNOLOGY

Although there is no universally accepted definition of Information Technology (IT), various attempts have been made in the literature to conceptualize it. For instance, Van Ark *et al* (2011) defined IT as an umbrella term encompassing communication devices and applications such as radios, televisions, cellular phones, computer hardware and software, satellite systems, and related services like videoconferencing and distance learning (van Ark & Gupta, 2011). Similarly, Ogbuabor *et al* (2017) included communication media (e.g., radio, television, CDs), information devices (e.g., computers, tablets), and telecommunication technologies (e.g., GPRS, satellite systems, mobile phones) in the definition of IT.

IT as a collection of stand-alone media, such as telephony, radio, and television, as well as computer-mediated networks connecting personal computers to the internet. These

definitions converge on several points: IT involves the generation and sharing of information, emphasizes the digital or electronic nature of this process, and extends beyond computers to include telecommunications equipment like mobile phones, printers, and televisions.

Martin (1999), as cited in Syamsuddin (2022), broadly defines information technology (IT) as encompassing both computer technology comprising hardware and software used for processing and storing information and communication technologies that enable the transmission of data. Building on this, an information technology system can be understood as a structured framework designed through the application of IT. Rusdiana and Irfan further elaborate on this by asserting that IT systems are not confined to tangible elements such as computers and printers; they also encompass intangible components like software. Consequently, the fundamental components of IT systems include data, hardware, software, networking devices, and human resources often referred to as "brainware" (Rusdiana & Irfan, 2014).One of the pivotal roles of information technology lies in its ability to overcome the constraints of time and space, enabling faster and more efficient access to data and information (Zadeh *et al*., 2017).

In its narrower sense, IT can be defined as the digital processing and utilization of information through electronic devices. However, in broader terms, IT refers to an integrated system incorporating the technologies and infrastructure necessary for storing, processing, and transmitting information. This definition also includes the legal and economic frameworks regulating IT usage and the social structures facilitating information sharing, infrastructure access, and innovation. As such, IT can be viewed as a general-purpose technology that enables individuals and organizations to communicate, innovate, and exchange information efficiently.

2.3 DIGITAL BANKING

Digital banking encompasses the complete digitization of traditional banking services, processes, and activities, allowing customers to access these services through digital platforms such as mobile applications, websites, and other online channels. This transformation enables customers to perform various banking functions without the need to visit a physical branch (DECTA, n.d).

Unlike traditional banks, which operate physical branches for in-person transactions and supplement their services with online options, digital banks function exclusively online. These fully digital institutions deliver their services via mobile apps and websites, eliminating the

need for physical locations and significantly reducing operational costs. Digital banking has revolutionized the way customers interact with financial institutions, offering a more convenient and cost-efficient alternative to traditional banking (DECTA, n.d)

Mobile banking applications, digital wallets, and online payment systems have significantly transformed the financial services landscape, providing users with unparalleled convenience and accessibility. These digital platforms enable individuals to conduct a wide range of financial activities, including fund transfers, bill payments, and online transactions, directly through their smartphones or connected devices. Digital wallets, seamlessly integrated with mobile technology, securely store debit and credit card information, facilitating contactless and efficient payments through widely adopted systems such as Apple Pay, Google Pay, and Samsung Pay. Moreover, these platforms incorporate advanced features such as real-time updates, overdraft protection, and tailored financial management tools, empowering users to monitor their spending, set savings goals, and effectively manage their accounts. Additionally, the integration of investment services, loan applications, and financial planning functionalities has expanded the scope of these systems, enabling users to access credit, consolidate debt, and oversee their investment portfolios with greater ease. By eliminating the need for physical branch visits and ensuring secure, efficient, and user-centric financial solutions, mobile banking applications and digital wallets have become indispensable elements of the modern financial ecosystem, driving the evolution of financial inclusion and digital transformation (DECTA, n.d). The pursuit of financial inclusion through information technology and digital banking remains a critical objective for financial institutions worldwide. However, this goal is hindered by several challenges that require strategic intervention to ensure long-term success. Prominent among these challenges are concerns over data security and privacy, regulatory ambiguities, limited digital literacy, and inadequate infrastructure. The increasing reliance on digital platforms demands robust measures to protect sensitive customer data, as breaches can erode trust and deter adoption. This necessitates the implementation of advanced encryption protocols, adherence to global privacy standards, and the development of a secure digital ecosystem (Adaga *et al*., 2024). Similarly, regulatory barriers pose significant obstacles. The rapidly evolving nature of financial technology highlights the urgent need for adaptive regulatory frameworks that balance fostering innovation with safeguarding consumer interests and ensuring system stability (Abaidoo & Agyapong , 2023).

Equally pressing is the issue of limited digital literacy, which undermines the ability of individuals to effectively utilize digital banking services. Institutions must prioritize

educational initiatives to enhance digital and financial literacy, empowering users to confidently navigate and benefit from these platforms (Hassan *et al*., 2024). Furthermore, inadequate infrastructure particularly in remote and underserved regions presents a substantial hurdle to equitable access. Weak communication networks and insufficient internet coverage exacerbate the digital divide, underscoring the need for investments in innovative technologies, such as advanced wireless systems and satellite solutions, to bridge these gaps (Nathan *et al*., 2022). Addressing these interconnected challenges through collaboration among governments, financial institutions, and technology providers is essential for creating an inclusive and resilient digital financial ecosystem that extends its benefits to all members of society.

2.4 THE ROLE OF INFORMATION TECHNOLOGY IN ENHANCING FINANCIAL INCLUSION THROUGH DIGITAL BANKING

The integration of Information Technology (IT) with the financial sector has revolutionized the accessibility and efficiency of financial services, playing a pivotal role in advancing financial inclusion. By addressing geographic and economic barriers, IT has enabled financial institutions to extend services to underserved and poor areas without the need for costly physical infrastructures. Traditional banking models often rely on the establishment of physical branches, which can be economically unfeasible in rural or remote areas. In contrast, IT-driven solutions, such as digital platforms, provide an alternative by delivering financial services through mobile phones, computers, and other communication technologies, thereby broadening the reach of financial institutions to previously excluded populations (Du & Liu , 2022). The transformative impact of mobile banking on financial performance is illustrated in a study by Harelimana (2018), which examined the case of Unguka Microfinance Bank Limited in Rwanda. The study revealed that Unguka Bank offered a diverse range of mobile banking services, including money transfers between accounts, bill payments, requests for check books and account statements, and mobile money services. These services not only increased the bank's revenue but also expanded the number of customers accessing banking services, thereby advancing financial inclusion within the community (Harelimana, 2018).

Digital banking has emerged as a cornerstone of technology-driven financial innovation, redefining how financial services are accessed and utilized. Developments in IT have facilitated the creation of transformative tools such as mobile applications, digital wallets, and online payment systems, which significantly enhance the efficiency, accessibility, and convenience of

financial transactions (Pradhan & Arvin, 2021). Through these advancements, digital banking has dismantled traditional barriers of time and geography, enabling users to manage accounts, conduct transactions, and access financial information seamlessly. This paradigm shift has been instrumental in integrating unbanked and underbanked populations especially in developing countries with limited traditional banking infrastructure into the formal financial system (Nnaomah *et al*., 2024). By fostering financial empowerment and reducing disparities, digital banking contributes to economic growth and social equity.

Among the most transformative aspects of IT integration in finance is the proliferation of mobile banking, which has seen remarkable global growth. This growth has been fueled by factors such as widespread mobile phone penetration, increased consumer demand for convenience, the strategic importance of mobile banking for financial institutions, and the relatively low levels of perceived security risks (Badiang & Nkwei, 2024).Mobile banking has proven particularly effective in bridging financial accessibility gaps in rural and underserved areas, where traditional banking services are scarce. By enabling individuals to perform financial transactions directly from their mobile devices, mobile banking plays a critical role in advancing financial inclusion and reshaping financial landscapes (Hordofa, 2023).

In parallel, digital wallets have emerged as vital enablers of financial inclusion within the broader spectrum of digital financial services. These tools offer secure and convenient payment options that cater to both individuals and businesses. digital financial services, including digital wallets, significantly enhance financial inclusion by providing access to financial tools for populations previously excluded from the financial system. However, the potential of these services is often contingent on adoption rates, which can be hindered by factors such as low digital literacy, limited access to technology, and concerns about data security (Fernandes *et al*., 2021).

based on the preceding discussion, we develop the following hypothesis:

Main Hypothesis:

H: There is a significant relationship between the use of information technology and financial inclusion.

Sub-Hypothesis:

H1: Mobile phones applications have a significant influence on financial inclusion;

H2: Digital wallets have a significant impact on financial inclusion;

H3: Online payment systems have a significant influence on financial inclusion.

3 METHODOLOGY

3.1 STUDY POPULATION AND SAMPLE

The study population consisted of employees from commercial banks operating in Batna Province. A random sample of 50 employees was selected, and a structured questionnaire was distributed to the participants through a QR code to ensure secure and efficient data collection. Out of the 50 questionnaires distributed, 43 were successfully retrieved, resulting in a response rate of 86%. These responses provided a solid foundation for the statistical analysis and interpretation of the study's findings.

Table 1

Distributed and returned forms.

The targeted Banks	Distributed forms	Returned forms	percentage
Banque de l'Agriculture et du Développement Rural	10	10	100%
Banque Nationale d'Algérie	10	6	60%
Crédit Populaire d'Algérie	10	10	100%
Banque de Développment Local	10	10	100%
Al Baraka Bank Algeria	10	7	70%
Total	50	43	86%

Source: Prepared by the researcher

3.2 STUDY INSTRUMENTS

To achieve the study's objectives, a carefully designed questionnaire was utilized as the primary data collection tool. The questionnaire was structured into two distinct sections to address different aspects of the research. The first section was dedicated to collecting demographic and personal information about the participants. This information was crucial for verifying the reliability and representativeness of the responses, as well as for understanding the background characteristics of the sample. The second section focused on the core variables of the study. The information technology variable was measured using 15 items categorized into three dimensions to capture its multiple facets comprehensively. Similarly, the financial inclusion variable was assessed using 10 items designed to reflect its key components. The design of the questionnaire ensured that it was both comprehensive and targeted, enabling a detailed examination of the relationships between the variables.

3.3 STATISTICAL METHODS

The collected data were analysed using SPSS version 26, employing a range of advanced statistical techniques to ensure accurate and meaningful insights. The following methods were applied:

a) Descriptive statistics (mean and standard deviation) were used to summarize and describe the distribution of responses, providing an overview of the participants' perspectives on the study variables;

b) Cronbach's Alpha test was conducted to assess the reliability and internal consistency of the questionnaire. This step was essential to ensure that the instrument produced dependable and valid results;

c) Correlation analysis was applied to determine the strength and direction of the relationships between the study variables, offering insights into how information technology and financial inclusion are interconnected;

d) Normality test: Conducted to verify whether the dataset conformed to a normal distribution, which is a prerequisite for the application of several statistical tests. This step was essential to ensure the accuracy and validity of the results;

e) Multiple linear regression analysis was performed to quantify the impact of the independent variable (information technology) on the dependent variable (financial inclusion). This method allowed for a deeper understanding of the extent to which variations in information technology influence levels of financial inclusion.

4 RESEARCH RESULTS

4.1 RELIABILITY

Table 2 presents Cronbach's Alpha coefficients for different constructs and dimensions, assessing the reliability of the study's measurement scale. The overall reliability score of 0.87 indicates a high level of internal consistency, as values above 0.7 are considered acceptable. The Information Technology section recorded the highest reliability at 0.89, covering three key dimensions: Mobile Phone Apps (0.84), Digital Wallets (0.85), and Online Payment Systems (0.82), all demonstrating strong reliability. Similarly, the Financial Inclusion section showed a high reliability score of 0.86, confirming the consistency of the measurement tools. Overall, these results indicate a high level of reliability, ensuring that the survey instruments effectively measure the intended variables with accuracy and consistency.

Table 2

Cronbach's Alpha Reliability Coefficients

N	Constructs	Items	Cronbach's Alpha
1	Section 1: Information Technology	15	0.89
	Dimension 1: Mobile phones Apps	5	0.84
	Dimension 2: Digital wallets	5	0.85
	Dimension 3: Online Payment Systems	5	0.82
2	Section 2: Financial Inclusion	10	0.86
Total		**25**	**0.87**

Source: Processed Data on SPSS V 26

4.2 NORMALITY TEST

The results confirm that parametric tests can be employed, such as Pearson correlation and regression analysis, which require data to follow a normal distribution. The Kolmogorov-Smirnov test results, as presented in Table 3, indicate significance values greater than 0.05, confirming that the variables of Information Technology and Financial Inclusion are normally distributed. This validates the appropriateness of using parametric statistical methods for further analysis.

Table 3

Results of Normality Test

Kolmogorov-Smirnov test			
Variables	**Coefficient**	**Significance level**	**Sampel Size**
Information Technology	0.105	0.200	43
Financial Inclusion	0.121	0.120	43

Source: Processed Data on SPSS V 26

4.3 DESCRIPTIVE ANALYSIS OF THE STUDY VARIABLES

The five-point scale used in this study was divided into three levels: high, moderate, and low. Scores above 3.67 are classified as high, while scores below 2.33 are considered low. Scores falling between these two thresholds are categorized as moderate (Sassenberg & Matschke, 2011).

Table 4 illustrates the significant role of mobile phone applications in enhancing financial services and promoting inclusion, with a strong overall mean of 4.60. The highest-rated item (4.74) indicates that mobile apps are particularly effective in facilitating access to financial services in remote areas, highlighting their impact in bridging geographic barriers. Smartphones were also recognized for expanding services to unbanked populations (4.65) and replacing traditional methods for daily financial transactions (4.51). Improving mobile network connectivity (4.62) and developing user-friendly banking apps (4.48) were also seen as key to advancing financial inclusion. Notably, the highest standard deviation (0.735) was associated with user-friendly apps, suggesting varied perceptions about their accessibility or effectiveness.

Table 4

Descriptive statistics of responses to questionnaire list questions of mobile phones apps

N	Constructs	Mean	Rank	Level	Std. deviation
1	The use of mobile phones applications contributes to facilitating access to financial services in remote areas.	4.74	1	High	0.441
2	Smartphones provide opportunities to expand banking services to unbanked individuals.	4.65	2	High	0.529
3	Customers increasingly rely on mobile phones to conduct daily financial transactions instead of traditional methods.	4.51	4	High	0.550
4	Developing user-friendly banking applications enhances the customer experience and facilitates financial inclusion processes.	4.48	5	High	0.735
5	Enhancing connectivity through mobile networks enables access to innovative financial services at low costs.	4.62	3	High	0.489
Total		4.60		High	0.439

Source: Processed Data on SPSS V 26

Table 5 highlights the significant role of digital wallets in promoting financial inclusion, with a high overall mean of 4.29, reflecting strong agreement among respondents. The highest-rated item (4.34) emphasizes that increasing trust in digital wallet platforms boosts their usage for financial transactions. Two statements followed closely (4.32) regarding digital wallets' effectiveness in simplifying access for the unbanked and reducing the rural-urban gap in financial service access. Respondents also acknowledged the role of digital wallets in enhancing user experience and speeding up transactions (4.25).

The highest standard deviation (0.638) was observed for the item on offering diverse digital wallet options, indicating varied opinions likely due to differences in availability or familiarity.

Table 5

Descriptive statistics of responses to questionnaire list questions Digital wallets

N	Constructs	Mean	Rank	Level	Std. deviation
1	Digital wallets contribute to simplifying access to financial services for individuals without traditional banking access.	4.32	2	High	0.565
2	Offering diverse digital wallet options helps integrate unbanked individuals into the financial system.	4.20	4	High	0.638
3	The adoption of digital wallets reduces the gap between rural and urban areas in accessing financial services.	4.32	2	High	0.565
4	Increasing trust in digital wallet platforms improves their usage rates for financial transactions.	4.34	1	High	0.482
5	Digital wallets enhance user experience and speed up the completion of financial transactions.	4.25	3	High	0.538
Total		4.29		High	0.443

Source: Processed Data on SPSS V 26

Table 6 highlights the importance of online payment systems in advancing financial inclusion, with an overall mean of (4.32), reflecting strong agreement. The highest-rated item (4.44) emphasized that online payment methods, such as QR codes and NFC technologies, enhance transaction speed and convenience.

Two items shared the second-highest mean (4.32): e-commerce payment gateways accelerating financial inclusion and online payment systems reducing geographical barriers. Trust in online payment platforms was also highlighted as important for adopting digital banking (4.30). The lowest-rated item (4.20) focused on providing secure payment options for unbanked individuals, though it still received high agreement. The highest standard deviation (0.778) was seen for the statement on e-commerce gateways, indicating more varied perceptions.

Table 6

Descriptive statistics of responses to questionnaire list questions Online payment systems

N	Constructs	Mean	Rank	Level	Std. deviation
1	Online payment systems, such as e-commerce payment gateways, accelerate the achievement of financial inclusion.	4.32	2	High	0.778
2	Providing secure and reliable online payment options encourages unbanked individuals to use digital financial services.	4.20	4	High	0.638
3	The adoption of online payment systems reduces geographical barriers in accessing financial services.	4.32	2	High	0.606
4	Increasing trust in online payment platforms improves the adoption of digital banking services.	4.30	3	High	0.557
5	Online payment methods, including QR codes and NFC technologies, enhance the convenience and speed of transactions.	4.44	1	High	0.547
Total		4.32		High	0.484

Source: Processed Data on SPSS V 26

4.4 REGRESSION ANALYSIS RESULTS

The regression analysis results presented in Table 7 provide insights into the relationship between the use of information technology (mobile phone applications, digital wallets, and online payment systems) and financial inclusion. The findings are analysed below considering the study's main hypothesis and sub-hypotheses:

Main Hypothesis:

"There is a significant relationship between the use of information technology and financial inclusion."

The regression model demonstrates a high correlation coefficient ($R = 0.695$), indicating a strong association between the independent variables (mobile phone apps, digital wallets, and online payment systems) and financial inclusion. The R^2 value of 0.484 shows that 48.4% of the variance in financial inclusion is explained using information technology. The F-statistic of 12.179 and its associated p-value (0.000) confirm that the model is statistically significant. Thus, the main hypothesis is supported, establishing that information technology plays a crucial role in promoting financial inclusion.

Sub-Hypotheses:

H1: Mobile phone applications have a significant impact on financial inclusion.

Beta = 0.249, t = 1.656, p = 0.106 (greater than 0.05). Although mobile phone applications show a relationship with financial inclusion (positive Beta value), the impact is not statistically significant at the 5% level. The hypothesis is rejected, indicating that mobile phone applications do not significantly influence financial inclusion.

H2: Digital wallets have a significant impact on financial inclusion.

Beta = 0.182, t = 1.264, p = 0.214 (greater than 0.05). Like mobile phone applications, digital wallets exhibit a relationship with financial inclusion. However, the effect is not statistically significant. The hypothesis is rejected, suggesting that digital wallets do not have a significant impact on financial inclusion.

H3: Online payment systems have a significant impact on financial inclusion.

Beta = 0.404, t = 2.913, p = 0.006 (less than 0.05). Online payment systems show a strong relationship with financial inclusion, and the effect is statistically significant. Conclusion: The hypothesis is accepted, confirming that online payment systems play a critical role in enhancing financial inclusion.

The Variance Inflation Factor (VIF) values for all independent variables (mobile phone apps: 1.715, digital wallets: 1.568, online payment systems: 1.452) are below 2, indicating no multicollinearity issues in the model. This ensures the reliability of the regression coefficients.

Table 7

Results of Regression Analysis

Regression Analysis									
Dependent variable	**Independent variables**	**R**	**R. Square**	**F. value**	**P-value**	**Beta**	**t**	**p-value**	**VIF**
Financial Inclusion	Mobile Phones apps	0.695	0.484	12.179	0.000	0.249	1.656	0.106	1.715
	Digital wallets					0.182	1.264	0.214	1.568
	Online payment systems					0.404	2.913	0.006	1.452

Source: Processed Data on SPSS V 26

4.5 CORRELATION RESULTS

The correlation analysis results in the Table 8 demonstrate significant positive relationships between all independent variables (mobile phone applications, digital wallets, and online payment systems) and financial inclusion. The strongest correlation is observed between online payment systems and financial inclusion (r = 0.618, p = 0.000), indicating that the adoption of online payment solutions significantly enhances financial inclusion.

Mobile phone applications also exhibit a notable correlation with financial inclusion (r = 0.566, p = 0.000), suggesting their role in facilitating access to financial services. Similarly, digital wallets show a moderate correlation with financial inclusion (r = 0.510, p = 0.000), reinforcing their importance in expanding financial accessibility. Furthermore, strong interrelationships exist among the independent variables, with mobile phone applications correlating significantly with digital wallets (r = 0.574, p = 0.000) and online payment systems (r = 0.525, p = 0.000). Likewise, digital wallets and online payment systems are positively correlated (r = 0.456, p = 0.001), indicating their complementary role in the digital financial ecosystem. Overall, the findings highlight the interconnected nature of digital financial technologies and their collective contribution to enhancing financial inclusion.

Table 8

Correlation Analysis

Correlation Analysis					
variables		**Mobile Phones apps**	**Digital wallets**	**Online payment systems**	**Financial Inclusion**
Mobile Phones apps	Pearson Correlation	1	.574**	.525**	.566**
	p- value	.	.000	.000	.000
Digital wallets	Pearson Correlation	.574**	1	.456**	.510**
	p-value	.000	.	.001	.000
Online payment systems	Pearson Correlation	.525**	.456**	1	.618**
	p- value	.000	.001	.	.000
Financial Inclusion	Pearson Correlation	.566**	.510**	.618**	1
	p- value	.000	.000	.000	.

**. Coefficient is significant at the 0.01 level (2-tailed). Source: Processed Data on SPSS V 26
*. Coefficient is significant at the 0.05 level (2-tailed)

5 DISCUSSION

The findings of this study highlight the critical role of digital Information technologies in advancing financial inclusion. Online payment systems emerged as the most influential factor, showing a strong and statistically significant positive impact on financial inclusion (r = 0.618, p = 0.000; Beta = 0.404, p = 0.006). Mobile applications and digital wallets also demonstrated positive correlations with financial inclusion (r = 0.566 and r = 0.510, respectively), but their impact was not statistically significant in the regression analysis. This suggests that while these tools have potential, their effectiveness may be hindered by challenges such as adoption barriers, usability issues, or infrastructure limitations.

These findings align with Fernandes *et al*. (2020), who emphasized the importance of digital financial tools while noting the potential challenges of adoption due to limited digital

literacy and security concerns. Similarly, the results support Hordofa (2023), who highlighted the role of mobile banking in improving financial accessibility in underserved areas, though the lack of statistical significance in this study's regression analysis for mobile applications indicates the need to address practical barriers. The results also parallel Harelimana's (2018) findings, which demonstrated the positive impact of digital banking services on financial inclusion and institutional performance, particularly using mobile and online platforms. Furthermore, the significant correlations observed between mobile applications, digital wallets, and online payment systems in this study reinforce the interconnected nature of these technologies. This interdependence reflects their complementary roles in fostering a robust digital financial ecosystem, consistent with prior research emphasizing the collective contribution of these tools to financial inclusion.

6 CONCLUSION

This study emphasizes the critical importance of information technology in fostering financial inclusion, with a particular focus on online payment systems, which emerged as the most significant driver with a statistically measurable impact. In contrast, mobile phone applications and digital wallets, while positively associated with financial inclusion, did not demonstrate statistical significance in the regression analysis. These results, derived from an empirical examination of a sample of banks in Batna province, Algeria, highlight the potential of digital financial tools to drive progress in financial inclusion, while also revealing the persistent challenges that limit their effectiveness. The findings align with prior research on the transformative potential of digital financial technologies, yet they also underscore the necessity of addressing barriers such as low adoption rates, usability challenges, and inadequate digital infrastructure. Strengthening these areas is essential to fully leverage the opportunities offered by these technologies and to advance comprehensive financial inclusion within the regional banking sector.

REFERENCES

Abaidoo , R., & Agyapong , E. K. (2023). Regulatory policy uncertainty, banking industry innovations and financial development among emerging markets. *Journal of financial economic policy, 15*(6), 613-627. doi:10.1108/JFEP-07-2023-0180

Abdullah , O., & Kazuo , I. (2020). Does financial inclusion reduce poverty and income inequality in developing countries? A panel data analysis.. *Journal of Economic Structures, 9*(1), 1-25. doi:10.1186/s40008-020-00214-4

Adaga, E. M., Egieya, Z. E., & Ewuga, S. K. (2024). PHILOSOPHY IN BUSINESS ANALYTICS: A REVIEW OF SUSTAINABLE AND ETHICAL APPROACHES. *International Journal of Management & Entrepreneurship Research, 6*(1), 69-86. Retrieved from https://doi.org/10.51594/ijmer.v6i1.710

Azmeh, c. (2019). Does the speed of adjustment in regulation and supervision affect financial stability in developing countries? *Journal of Financial Regulation and Compliance, 27*(4), 453-463. doi:10.1108/JFRC-08-2018-0111

Badiang, M. A., & Nkwei, E. (2024). Mobile banking adoption its antecedents and post-adoption effects: the role of consumers status orientation in an African context. *Cogent Business & Management, 11*(1), 2321787. Retrieved from https://doi.org/10.1080/23311975.2024.2321787

Barajas, A., Beck, T., Belhaj, M., & Ben naceur, S. (2020). Financial Inclusion: What Have We Learned So Far? What Do We Have to Learn? *International Monetary Fund, 2020*(157), 51. doi:10.5089/9781513553009.001.A001

Boot, A., Hoffmann, P., Laeven, L., & Ratnovski, L. (2021). Fintech: what's old, what's new? *Journal of Financial Stability, 53*, 100836. doi:10.1016/j.jfs.2020.100836

Brodny, J., & Tutak , M. (2022). Analyzing the Level of Digitalization among the Enterprises of the European Union Member States and Their Impact on Economic Growth. *Journal of Open Innovation: Technology, Market, and Complexity, 8*(2), 70. Retrieved from https://doi.org/10.3390/joitmc8020070

Burkett , I., & Sheehan, G. (2009). *From the Margins to the Mainstream: The Challenges for Microfinance in Australia.* Australia: Brotherhood of St Laurence. Retrieved from https://www.findevgateway.org/paper/2009/12/margins-mainstream-challenges-microfinance-australia

DECTA. (n.d). *A global payment processing company, experts in FinTech*. Retrieved from DECTA: https://www.decta.com/

Demirguc-Kunt, A., Klapper, L., & Singer, D. (2018). *The Global Findex Database 2017 : Measuring Financial Inclusion and the Fintech Revolution.* Washington: World Bank Group. Retrieved from http://documents.worldbank.org/curated/en/332881525873182837

Du , L., & Liu , Z. (2022). The Impact of Digital Finance on Credit Risk Constraints and Operational Efficiency of Commercial Banks. *Studies of International Finance*, 75-85. Retrieved from https://doi.org/10.16475/j.cnki.1006-1029.2022.06.004

Fernandes, C., Borges, M., & Caiado, J. (2021). The Contribution of Digital Financial Services to Financial Inclusion in Mozambique: An ARDL Model Approach. *Applied Economics, 53*(3), 400-409. doi:10.1080/00036846.2020.1808177

Harelimana, J. B. (2018). Impact of Mobile Banking on Financial Perforùance of Unguka Microfinance Bank LTD RWANDA. *Journal of Harmonized Research in Management, 4*(1), 26-40.

Hassan, A. O., Ewuga, S. K., Abdul, A. A., & Abrahams, T. O. (2024). CYBERSECURITY IN BANKING: A GLOBAL PERSPECTIVE WITH A FOCUS ON NIGERIAN PRACTICES. *Computer Science & IT Research Journal, 5*(1), 41-59. Retrieved from https://doi.org/10.51594/csitrj.v5i1.701

Hordofa, D. F. (2023). Impact of Mobile Banking Adoption on the Technical Efficiency of Commercial Banks in Ethiopia: An Analysis from 2010 to 2022. *Researche square*, 1-12. Retrieved from https://doi.org/10.21203/rs.3.rs-3146976/v1

Khan, I., Khan, I., & Sayal, A. (2021). Does financial inclusion induce poverty, income inequality, and financial stability: Empirical evidence from the 54 African countries? *Journal of Economic Studies, 49*(2), 301-314. doi:10.1108/JES-07-2020-0317

Leyshon, A., & Thrift, N. (1994). Access to Financial Services and Financial Infrastructure Withdrawal: Problems and Policies. *Blackwell Publishing, 26*(3), 268-275. Retrieved from http://www.jstor.org/stable/20003457

Mursalov, M., Yarovenko, H., & vasilyeva, T. (2023). Entrepreneurial Ecosystem and Digitalization: Relationship and Synergy of Development. *Leadership, Entrepreneurship and Sustainable Development Post COVID-19* (pp. 109-127). cham: Springer Nature Switzerland. Retrieved from https://doi.org/10.1007/978-3-031-28131-0_9

Nathan, R. J., Setiawan , B., & Quyn, M. (2022). Fintech and Financial Health in Vietnam during the COVID-19 Pandemic: In-Depth Descriptive Analysis. *Journal of Risk and Financial Management, 15*(3), 125. Retrieved from https://doi.org/10.3390/jrfm15030125

Nchofoung, T., & Asongu, S. (2022). ICT for Sustainable Development: Global Comparative Evidence of Globalisation Thresholds. *Telecommunications Policy, 46*(5), 37. Retrieved from https://dx.doi.org/10.2139/ssrn.4000834

Nnaomah, U. I., Aderemi, S., & Olutimehin, D. O. (2024). DIGITAL BANKING AND FINANCIAL INCLUSION: A REVIEW OF PRACTICES IN THE USA AND NIGERIA. *Finance & Accounting Research Journal, 6*(3), 463-490. Retrieved from https://doi.org/10.51594/farj.v6i3.971

Ogbuabor, J. E., .Agu, M. N., & Kalu, U. I. (2017). The social impacts of information and communication technology in Negeria. *International Journal of Economics and Financial, 7*(2), 524-529. Retrieved from https://ideas.repec.org/a/eco/journ1/2017-02-69.html

Polloni-silva, E., da Costa, N., & Moralles, H. (2021). Does Financial Inclusion Diminish Poverty and Inequality? A Panel Data Analysis for Latin American Countries. 158(3),. *Social Indicators Research, 158*(3), 889-925.

Pradhan, R., & Arvin, M. B. (2021). Sustainable economic development in India: The dynamics between financial inclusion, ICT development, and economic growth. *Technological Forecasting and Social Change, 169*, 120758. Retrieved from https://www.sciencedirect.com/science/article/pii/S0040162521001906

Rusdiana, M. M., & Irfan, S. T. (2014). *Management Information System.* (S. M. Beni Ahmad , Ed.) Bandung: CV Pustaka Setia.

Sassenberg, K., & Matschke, C. (2011). The impact of discrepancies from ingroup norms on group members' well-being and motivation. *European Journal of Social Psychology*, *41*(7), 886-897. Retrieved from https://doi.org/10.1002/ejsp.833

Syamsuddin. (2022). The effect of information technology on the quality of financial reports in the regional financial management agency of Takalar Regency. *Journal of Economics and Business Letters, 2*(3), 8-11. Retrieved from https://doi.org/10.55942/jebl.v2i3.161

Teixeira, J. E., & Ana Teresa, T.-L. (2022). Industry 4.0 in the European union: Policies and national strategies. *Technological Forecasting and Social Change*, *180*(c). Retrieved from https://doi.org/10.1016/j.techfore.2022.121664

van Ark, H. H., & Gupta, A. (2011). Measuring the contribution of ICT to economic growth. In B. Ark, & B. Ark (Ed.), *The linked world: How ICT is transforming societies, cultures, and economies* (pp. 9-35). Madrid: Fundación Telefónica.

Vogel, H., Maas, J., & Gebauer, A. (2011). *Drug Discovery and Evaluation: Methods in Clinical Pharmacology*. London: Springer.

yunus, M. (2010). *Banker to the Poor: Micro-Lending and the Battle Against World Poverty*. 368: ReadHowYouWant.com, Limited. Retrieved from https://books.google.dz/books?id=tkmqSFvRT3UC

Zadeh, M. K., Karkon, A., & Golnari, H. (2017). The Effect of Information Technology on the Quality of Accounting Information. *Journal of System Management, 3*(3), 61-76.