



The Impact of Cloud-Based Systems on Accounting Operations in Islamic Banks: A Case Study of Al-Yaqeen Bank, Libya

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أثر استخدام الأنظمة السحابية على العمليات المحاسبية في المصارف الإسلامية
دراسة تطبيقية على مصرف اليقين - ليبيا

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Received: February 11, 2025

Accepted: April 06, 2025

Published: April 20, 2025

Abstract:

This study investigates the impact of cloud computing systems on accounting operations within Islamic banks, focusing on an applied case study of Al-Yaqeen Bank in Libya. In light of the increasing global adoption of cloud technologies and their potential to enhance operational performance, the research aims to evaluate their effectiveness in improving accounting efficiency, accuracy, data security, and cost management in the Libyan context. Using a structured questionnaire distributed to employees of the Financial Management Department at Al-Yaqeen Bank, the study adopts a descriptive and analytical approach, employing statistical tools such as the Shapiro–Wilk test and one-sample t-test to assess hypotheses across four dimensions. The results reveal that cloud systems significantly improve the efficiency of accounting operations, enhance the accuracy of financial reports, and reduce human error. Additionally, cloud platforms contribute to greater data security despite prevailing cybersecurity concerns and reduce long-term operational costs, even in the face of high initial investment. However, the study also highlights that inadequate telecommunications infrastructure and the lack of skilled personnel significantly constrain the effective adoption of cloud systems. Based on these findings, the study recommends the strategic adoption of cloud technologies in Islamic banks, coupled with investments in digital infrastructure and human capital development, to optimize the benefits of digital transformation in Libya's financial sector.

Keywords: Cloud computing, Islamic banking, accounting systems, data security, operational efficiency, Al-Yaqeen Bank, Libya.

المخلص

تهدف هذه الدراسة إلى تحليل أثر استخدام الأنظمة السحابية على العمليات المحاسبية في المصارف الإسلامية، مع التركيز على دراسة تطبيقية في مصرف اليقين بلبيبا. وفي ظل التوسع العالمي في تبني تقنيات الحوسبة السحابية وإمكاناتها في تحسين الأداء التشغيلي، تسعى الدراسة إلى تقييم فعاليتها في تحسين كفاءة العمليات المحاسبية، ودقة التقارير المالية، وأمن البيانات، وإدارة التكاليف في السياق الليبي. تم جمع البيانات من خلال استبانة موجهة إلى موظفي قسم الإدارة المالية في الإدارة العامة لمصرف اليقين، واعتمدت الدراسة المنهج الوصفي التحليلي باستخدام أدوات إحصائية مثل اختبار شابيرو-ويلك واختبار T للعينة الواحدة لاختبار الفرضيات عبر أربعة محاور رئيسية. وقد أظهرت النتائج أن الأنظمة السحابية تحسن بشكل كبير من كفاءة العمليات المحاسبية، وترفع من دقة التقارير المالية، وتقلل من الأخطاء البشرية. كما تسهم هذه الأنظمة في تعزيز أمان البيانات رغم المخاوف المتعلقة بالأمن السيبراني، وتقلل من التكاليف التشغيلية على المدى الطويل، على الرغم من ارتفاع التكاليف الأولية للتطبيق. ومع ذلك، كشفت الدراسة أن ضعف البنية التحتية للاتصالات ونقص الكوادر المؤهلة يُعدان من أبرز العوائق التي تحد من فعالية تطبيق هذه الأنظمة. وبناءً على ذلك، توصي الدراسة بتبني استراتيجي للأنظمة السحابية في المصارف الإسلامية، إلى جانب الاستثمار في البنية التحتية الرقمية وتنمية الموارد البشرية، لتعزيز فوائد التحول الرقمي في القطاع المالي الليبي.

الكلمات المفتاحية: الحوسبة السحابية، المصارف الإسلامية، النظم المحاسبية، أمن البيانات، الكفاءة التشغيلية، مصرف اليقين، ليبيا.

Introduction

Cloud-based systems have emerged as one of the most significant technological innovations impacting global business sectors, including the banking industry, a cornerstone of economic infrastructure. In Libya, banks face considerable challenges such as underdeveloped telecommunications infrastructure and an urgent need to enhance the efficiency of accounting operations to ensure accuracy and transparency. Cloud computing offers an innovative solution by enabling banks to manage their financial data with greater ease and high security, while also reducing operational costs through reliance on internet-based services rather than investing in costly on-premise servers (Ali et al., 2022). Given the current circumstances in Libya, cloud-based systems represent a strategic tool for improving accounting performance and aligning with ongoing technological advancements.

Research Problem:

Amidst the accelerating pace of technological advancement, cloud computing systems have become vital tools for enhancing accounting operations in the global banking sector. However, Islamic banks in Libya face significant challenges that hinder the full integration and utilization of this technology. These challenges include inadequate telecommunications infrastructure, a shortage of skilled personnel, security concerns, and high initial implementation costs within a context of economic instability. Such obstacles negatively affect the efficiency and accuracy of accounting processes, undermine the banks' ability to achieve transparency, reduce errors, and ultimately compromise the overall effectiveness of their financial operations. Despite the transformative potential of cloud technologies, there remains a notable paucity of empirical studies focusing on their impact within Libyan Islamic banking institutions. This knowledge gap limits our understanding of how effectively these systems can mitigate local constraints and deliver their anticipated benefits. Accordingly, the central research problem is formulated as follows:

To what extent do cloud computing systems influence the efficiency, accuracy, and security of accounting operations in Islamic banks in Libya, given the prevailing local challenges such as inadequate infrastructure and insufficient technical expertise?

Research Hypotheses:

Based on the stated research objectives and problem, the following hypotheses are proposed:

Hypothesis One:

The implementation of cloud computing systems leads to improved efficiency in accounting operations, enhances the accuracy of financial reporting, and reduces human errors in accounting processes within Libyan Islamic banks.

Hypothesis Two:

Cloud computing systems contribute to strengthening the security of financial data in Islamic banks in Libya, despite ongoing concerns regarding data breaches and cybersecurity risks.

Hypothesis Three:

The adoption of cloud technologies results in a long-term reduction of operational costs related to accounting processes in Libyan Islamic banks, notwithstanding the burden of high initial capital investment.

Hypothesis Four:

The effectiveness of cloud computing systems in enhancing accounting operations in Libyan Islamic banks is constrained by the weak telecommunications infrastructure and the shortage of qualified personnel.

Study Objective and Significance:

This study seeks to analyze the impact of cloud computing systems on accounting operations in Islamic banks, focusing on four core dimensions: operational efficiency, reporting accuracy, data security, and cost reduction. It places particular emphasis on contextual barriers such as limited internet connectivity and the scarcity of trained professionals (Al-Saghir, 2021). The significance of this research stems from the urgent need to modernize Libya's banking sector. Recent studies have indicated that cloud technologies can substantially improve the quality of financial reporting and minimize accounting errors (Al-Qadi & Abdulrahman, 2023). The study will employ a theoretical framework to review relevant concepts and potential impacts, supported by empirical data collected via a structured questionnaire. The survey targets financial department employees at the General Directorate of Al-Yaqin Islamic Bank, thereby providing practical insights into current adoption experiences and challenges.

Concept of Cloud Computing Systems

Cloud computing refers to a modern technological paradigm that delivers computing services—such as data storage, processing power, database management, and software applications—via the Internet, as an alternative to relying on locally-owned hardware and servers. This model is based on a network of remote servers managed by cloud service providers such as Amazon Web Services (AWS) and Microsoft Azure, allowing users to access computing resources with high flexibility and scalability according to their specific needs (Mell & Grance, 2011).

Cloud computing systems are typically classified into three primary service models:

- Infrastructure as a Service (IaaS): Offers fundamental resources such as virtual servers and storage infrastructure.
- Platform as a Service (PaaS): Provides an environment for developing, testing, and deploying applications.
- Software as a Service (SaaS): Delivers ready-to-use software solutions, including platforms like Google Workspace or cloud-based accounting software such as QuickBooks Online (Al-Ghamdi, 2021).

In the accounting context, cloud-based systems are employed to store financial data, process transactions, and generate financial reports with enhanced accuracy and efficiency, thereby boosting operational performance.

The conceptual foundation of cloud computing emerged in the early 21st century alongside the evolution of internet technologies, initially as a resource-sharing framework and later as a cornerstone technology in the financial and banking sectors (Hashem et al., 2015). Cloud computing offers numerous advantages, including:

- Global accessibility to data from any internet-connected device.
- Reduced capital expenditure by eliminating the need for costly hardware.
- Automatic software updates to maintain compliance with evolving industry standards.
- Enhanced security, achieved through encryption and advanced provider-based protection protocols.

For Libyan banks, cloud computing holds the potential to enhance accounting operations by accelerating data processing and minimizing human error. However, the successful implementation of such systems necessitates robust internet infrastructure and targeted employee training. As part of a broader digital transformation agenda, cloud technologies are strategically aligned with efforts to foster innovation and optimize resource management in the financial sector, particularly under current economic constraints.

Concept of Accounting Operations

Accounting operations are defined as the set of activities and procedures undertaken to record, classify, and consolidate an institution's financial data for the purpose of preparing financial statements that accurately reflect its performance and financial position. These operations encompass the documentation of daily business transactions (e.g., sales and purchases), preparation of journal entries, posting to ledger accounts, and compilation of financial statements (Warren et al., 2017). The primary objective of accounting operations is to provide reliable and accurate information to internal decision-

makers, such as managers, and external stakeholders, such as investors and regulatory bodies (Al-Sayyid, 2020).

In the banking context, accounting operations include managing customer accounts, recording interest and service charges, monitoring loans and deposits, and ensuring compliance with applicable accounting standards. These processes are fundamental to maintaining financial transparency and regulatory compliance (Kieso et al., 2020). Traditionally executed manually through ledgers, these operations have increasingly been digitized through advanced accounting information systems, enhancing speed and reducing errors.

In Libya, accounting operations within the banking sector encounter challenges such as the lack of advanced digital systems and insufficient staff training, which negatively affect operational efficiency. Cloud computing systems can play a critical role in addressing these challenges by offering flexible, automated solutions for managing financial data and streamlining accounting procedures.

The Importance of Cloud Computing in Accounting Operations

Instant Data Accessibility

One of the most salient benefits of cloud computing in accounting operations is the ability to access financial data instantly from virtually any location via the Internet. This flexibility allows accountants to review financial records and process transactions without being physically present at the office, thus enhancing business continuity (Garrison et al., 2012). In the banking sector, especially in environments like Libya where power outages or security disturbances frequently disrupt access to corporate premises, this capability becomes essential. For instance, an accountant at Al-Wahda Bank can manage deposit transactions remotely, thereby improving time management and facilitating rapid decision-making. Moreover, cloud systems support remote work models, which are crucial during periods of crisis. As such, cloud computing offers a practical solution for overcoming local logistical constraints.

Reduction in Operational Costs

Cloud computing significantly reduces operational expenditures by eliminating the need for large capital investments in hardware infrastructure, such as physical servers, as well as the ongoing maintenance costs associated with them. Instead, banks can subscribe to cloud-based services under a pay-as-you-go model (Al-Saadi, 2022). In Libya's current economic climate, characterized by liquidity shortages and oil market volatility, this cost-efficiency is particularly advantageous. For example, Al-Saray Bank can leverage cloud solutions instead of procuring expensive hardware, thereby reallocating financial resources toward strategic priorities such as service enhancement. Additionally, cloud computing reduces energy consumption costs typically associated with running on-premise servers, contributing to financial efficiency under economic constraints.

Automated Software Updates

Cloud platforms provide automatic updates to accounting software, ensuring that systems remain compliant with the latest international financial reporting standards (e.g., IFRS) without manual intervention or additional expenditures (Hashem et al., 2015). For Islamic banks in Libya, where regulatory compliance with Central Bank directives is mandatory, this functionality ensures seamless adherence to current legislation. For instance, the Bank of Commerce and Development can rely on real-time software updates to meet emerging regulatory requirements, minimizing the risks associated with outdated software. Automated updates also save time and labor previously spent on manual reprogramming, thus improving the reliability and timeliness of accounting practices.

Enhanced Security and Data Protection

Cloud computing systems provide robust data security frameworks, incorporating advanced encryption technologies and security protocols offered by service providers to protect sensitive financial data from cyberattacks or loss (Hashem et al., 2015). In the context of Islamic banking, where trust in financial systems is paramount for customer acquisition and retention, enhanced security bolsters institutional credibility and operational stability. For example, any bank can safeguard deposit records against cybersecurity threats, a critical consideration in Libya's volatile security environment. Furthermore, automated data backups ensure business continuity. Compared to the vulnerabilities of local storage systems, cloud-based solutions markedly reduce data loss risks, thereby strengthening the integrity and reliability of accounting operations.

Increased Efficiency and Error Reduction

Cloud computing improves operational efficiency by automating key accounting tasks such as transaction logging, financial reporting, and data analytics, which significantly reduces human error and expedites task completion (Al-Saadi, 2022). In Islamic banks, where traditional systems often suffer from inefficiencies, cloud technologies can enhance the quality of financial reporting despite challenges such as limited technical expertise. For instance, interest calculations can be automated with high precision, reducing the time spent on manual auditing and improving the accuracy of financial

statements. The ability to seamlessly process large volumes of data through automation represents a substantial advancement in the overall performance of accounting operations.

Cloud computing has emerged as a transformative force in modern accounting, offering substantial advantages in terms of efficiency, accuracy, cost reduction, and operational resilience. Through enabling real-time access to financial data, cloud systems empower accountants and financial professionals to make informed decisions swiftly, regardless of geographic location. The automation of routine accounting tasks not only minimizes human error but also accelerates data processing, resulting in more accurate and timely financial reporting. Additionally, the reduction of capital expenditures on hardware and the provision of scalable, subscription-based models make cloud solutions particularly appealing in economically constrained environments such as Libya. Enhanced data security, through encryption and automated backups, further reinforces trust in financial systems, an essential component for customer retention and regulatory compliance in the banking sector. Despite challenges related to infrastructure and technical capacity, cloud computing presents a strategic opportunity for Libyan Islamic banks to modernize their accounting functions, improve financial transparency, and align with global best practices. As such, its adoption is not merely a technological upgrade but a critical step toward building a resilient, efficient, and future-ready financial sector.

The Impact of Cloud Computing on Accounting Operations

Enhancing Efficiency and Speed

One of the most prominent impacts of cloud computing on accounting operations is the significant improvement in operational efficiency and processing speed. Cloud platforms facilitate real-time data processing, thereby reducing the time required for transaction entry and financial report generation (Trigo et al., 2014). In Islamic banking institutions, this capability can help mitigate delays typically associated with traditional accounting systems, ultimately enhancing overall operational performance.

Improving Accuracy and Reducing Errors

Cloud systems contribute to enhanced accuracy in accounting processes by automating key functions, thereby minimizing human intervention and the associated likelihood of error. Empirical studies have demonstrated that cloud-based software such as *QuickBooks Online* significantly reduces accounting inaccuracies compared to manual data entry methods (Al-Saadi, 2022). For Libyan banks, this improvement is particularly crucial for ensuring the integrity and reliability of financial reporting.

Strengthening System Integration

Cloud computing promotes seamless integration between accounting functions and other critical systems such as electronic banking platforms and customer relationship management (CRM) systems. This interconnectedness provides a comprehensive view of an institution's financial performance (Hashem et al., 2015). Within the Libyan context, such integration has the potential to improve the management of deposits and loans, although it is contingent on the availability of supportive infrastructure.

Enhancing Oversight and Risk Management

Cloud-based systems enhance financial oversight and risk management capabilities by offering advanced analytical tools and transparent audit trails. These features enable the rapid identification of financial anomalies and irregularities (Trigo et al., 2014). For banks, this translates into stronger compliance with central bank regulations and a reduction in fraud-related risks.

Reducing Costs and Enhancing Flexibility

Cloud technologies help reduce expenditures associated with purchasing and maintaining hardware and software. Furthermore, they offer scalability, allowing institutions to expand or contract their computing resources based on operational needs (Al-Saadi, 2022). This makes cloud computing an economically viable solution for modernizing accounting operations, particularly in resource-constrained environments.

Challenges Related to Implementation

Despite these benefits, the implementation of cloud computing in Islamic banks may encounter obstacles such as limited internet connectivity and a shortage of skilled personnel, factors that could diminish its overall effectiveness (Hashem et al., 2015). Overcoming these challenges requires targeted investment in digital infrastructure and comprehensive training programs to build institutional capacity.

Challenges Associated with the Implementation of Cloud Computing Systems in Libya

Weak Telecommunications Infrastructure

One of the most critical challenges impeding the adoption of cloud computing in Libya is the inadequacy of telecommunications infrastructure. Cloud technologies require stable and high-speed internet connectivity to ensure effective access to remote servers. However, Libya suffers from poor network coverage, frequent service interruptions, and low data speeds, particularly in rural areas and smaller towns outside of Tripoli and Benghazi (Al-Maghribi, 2023). For instance, a bank operating in the city of Sabha may encounter service outages while attempting to update sensitive financial data, leading

to the disruption of core accounting functions. Given that financial operations demand high service continuity, the current telecommunications environment undermines the viability of cloud-based solutions in the banking sector. Unless significant investments are made to expand telecom infrastructure, such as the deployment of new communication towers or the modernization of fiber-optic networks, this challenge will remain a fundamental obstacle to digital transformation.

Shortage of Skilled Personnel

The technical sector in Libya faces a considerable shortage of qualified professionals capable of managing and operating cloud computing systems, which poses a major barrier to the effective utilization of such technologies. Research indicates that the absence of specialized training programs in areas such as cybersecurity, cloud data management, and application development weakens the capacity of banks to transition successfully to cloud-based platforms (Al-Saadi, 2022). In Islamic banking institutions, employees are often required to possess advanced competencies in platforms such as Microsoft Azure or Amazon Web Services. However, the prevailing situation reveals that most staff are only familiar with basic functions of traditional systems. This skills gap hampers the digital transition and may expose systems to operational risks if implemented without adequate expertise. Addressing this issue requires the development of targeted training initiatives in collaboration with universities or international service providers.

Security and Privacy Concerns

Security-related apprehensions constitute a significant barrier to the adoption of cloud technologies in Libya, particularly in light of the growing prevalence of global cyberattacks. Islamic banks are especially hesitant to store sensitive financial data, such as customer accounts and transaction records, on external servers that may be vulnerable to hacking or surveillance (Hashem et al., 2015). These concerns are compounded by the weakness of domestic data protection legislation, which often leaves accountability unclear in the event of a data breach. Consequently, some institutions refrain from cloud adoption due to fears of losing control over their proprietary data. These issues erode trust in cloud technologies and underscore the urgent need to strengthen security protocols and enact comprehensive legal frameworks to safeguard data privacy and institutional accountability.

High Initial Costs and Economic Instability

Although cloud computing offers substantial cost savings over the long term, the initial costs associated with adoption present a significant financial burden that may discourage many institutions from pursuing this option. Implementation expenses include subscription fees, data migration costs, and employee training, investments that may be prohibitive for some banks, particularly in an economy characterized by fluctuating oil revenues and liquidity crises (Trigo et al., 2014). Institutions struggling with day-to-day operational challenges may find it difficult to allocate sufficient budgetary resources to cloud initiatives. As a result, many prefer to retain traditional accounting systems, despite their limitations, rather than risking scarce financial resources on an investment that may not yield immediate returns.

Field Study

Research Instrument

Questionnaire

The researcher employed a structured questionnaire as the primary tool for data collection in order to gather the necessary information pertaining to the study's subject. The questionnaire was divided into two main sections:

- **Section One: General Information**
This section includes demographic and background variables such as gender, age, job title, and years of experience in the banking sector.
- **Section Two: Thematic Dimensions**
This section is composed of four thematic axes, each designed to measure specific aspects of the research hypotheses:
 - **Axis One:** *"The implementation of cloud computing systems leads to increased efficiency in accounting operations, improved accuracy in financial reporting, and reduced human errors in accounting processes in Libyan Islamic banks."*
This axis consists of four statements.
 - **Axis Two:** *"Cloud computing contributes to enhancing the security of financial data in Libyan Islamic banks, despite prevailing security concerns and the inadequacy of local data protection regulations."*
This axis includes two statements.
 - **Axis Three:** *"The use of cloud computing systems reduces the long-term operational costs of accounting processes in Libyan Islamic banks, despite the burden of high initial setup costs."*
This axis includes two statements.

- Axis Four: *“Weak telecommunications infrastructure and the shortage of qualified personnel limit the effectiveness of cloud computing systems in improving accounting operations in Libyan Islamic banks.”*

This axis also includes two statements.

Statistical Methods and Tools Used for Data Analysis

The responses to the questionnaire were based on a five-point Likert scale, where:

- "Strongly Disagree" = 1
- "Disagree" = 2
- "Neutral" = 3
- "Agree" = 4
- "Strongly Agree" = 5

Upon collection and verification of the completed questionnaires, data were processed and analyzed using the statistical software package SPSS. To achieve the study's objectives, the researcher employed a descriptive and analytical methodology, utilizing the following statistical tools:

- Frequency distribution and percentage
- Weighted arithmetic mean
- General arithmetic mean
- Standard deviation
- Ranking
- Shapiro–Wilk test for normality
- One-sample t-test for inferential analysis

Study Sample

The study sample consisted of employees from the Financial Management Department at the General Directorate of Al-Yaqin Bank. A total of nine questionnaires were distributed and all were returned; however, one was excluded due to invalid responses, leaving eight valid questionnaires for analysis.

Statistical Analysis

Descriptive Statistics of General Information

Table 1 presents the frequency and percentage distribution of the respondents' demographic data based on the personal information variables of the study sample.

Table (1): Frequency and Percentage Distribution of General Information Variables.

Variable	Category	Percentage
Gender	Male	75.0
	Female	25.0
Age Group	Under 30 years old	25.0
	From 30 to 40 years old	12.5
	Over 40 years old	37.5
	Not written	25.0
Job title	Accountant	75.0
	Financial Manager	12.5
	Auditor	12.5

From Table 1, the following findings are evident:

- 75.0% of the study participants are male.
- 37.5% of the sample are aged above 40 years.
- 75.0% of the participants hold the job title of accountant.
- 75.0% of the sample have more than five years of professional experience.

The implementation of cloud computing systems leads to increased efficiency in accounting operations, improved accuracy of financial reporting, and reduced human error in accounting processes within Libyan Islamic banks. Table 2 presents the descriptive statistics related to this axis, including the mean score, standard deviation, ranking of each statement, and its relative importance.

Table (2): Arithmetic Mean, Standard Deviation, Ranking, and Relative Importance of Statements in the First Axis.

Num.	Axis Statements	Arithmetic Mean	Standard Deviation	Phrase Order	Importance Percentage
1	Cloud systems speed up financial reporting.	4.38	0.74	2	87.5
2	Cloud systems reduce errors in accounting records.	4.25	0.71	3	85.0
3	Cloud systems improve integration with other accounting and banking systems.	4.50	0.76	1	90.0
4	Cloud systems enhance compliance with international accounting standards.	4.00	0.53	4	80.0
Total Pillar		4.28	0.59	-	85.6

The results presented in Table 2 indicate that the mean responses for the statements in this axis ranged between 4.00 and 4.50, with an overall mean of 4.28 and a corresponding relative importance of 85.6%. The highest-ranked statement was Statement 3: "Cloud systems enhance integration between accounting systems and other banking platforms," which received a mean score of 4.50 and a relative importance of 90.0%, placing it in first rank among the items assessed.

The implementation of cloud computing systems does not lead to increased efficiency in accounting operations, improved accuracy of financial reporting, or reduction of human error in accounting processes within Libyan Islamic banks. Given that the sample size is fewer than 30 observations, the researcher applied the Shapiro, Wilk test to assess whether the data for this axis follows a normal distribution. Subsequently, a one-sample t-test was used to evaluate the null hypothesis. Table 3 presents the results of both the Shapiro–Wilk normality test and the one-sample t-test.

Table (3): Results of the Shapiro–Wilk Normality Test and One-Sample t-Test for the First Axis.

Overall mean	Standard deviation	Statistical value	Observed significance level	T-statistical value	Observed significance level
4.281	0.589	0.952	0.728	6.151	0.000

From Table 3, the following can be concluded:

- The observed p-value from the Shapiro–Wilk test is 0.728, which is greater than the significance level of 0.05, indicating that the data follows a normal distribution.
- The observed p-value from the one-sample t-test is 0.000, which is less than the significance level of 0.05.

This result leads to the rejection of the null hypothesis, confirming that:

- The implementation of cloud computing systems leads to increased efficiency in accounting operations, improves the accuracy of financial reporting, and reduces human errors in accounting processes within Libyan Islamic banks.

Statistical Analysis of the Second Axis

Cloud computing contributes to enhancing the security of financial data in Islamic banks in Libya, despite concerns related to cybersecurity.

Table 4 presents the descriptive statistics related to this axis, including the mean scores, standard deviations, ranking of each statement, and their corresponding relative importance.

Table (4): Arithmetic Mean, Standard Deviation, Ranking, and Relative Importance of Statements in the Second Axis.

Num.	Axis Statements	Arithmetic Mean	Standard Deviation	Phrase Order	Importance Percentage
1	Cloud systems provide a secure environment for storing financial data.	4.50	0.76	1	90.0
2	Security concerns reduce trust in cloud systems.	3.63	1.06	2	72.5
Total Axis		4.06	0.82	-	81.3

The results in Table 4 reveal that the mean response values for the statements within this axis range from 3.63 to 4.50, with an overall mean of 4.06 and a relative importance of 81.3%. The highest-rated

statement was Statement 1: “Cloud systems provide a secure environment for storing financial data,” which ranked first with a mean score of 4.50 and a relative importance of 90.0%.

Cloud computing does not contribute to enhancing the security of financial data in Islamic banks in Libya, despite existing cybersecurity concerns. Given that the sample size is less than 30 observations, the researcher employed the Shapiro–Wilk test to determine whether the data for this axis follows a normal distribution. Following the confirmation of data normality, a one-sample t-test was conducted to assess the stated hypothesis. Table 5 presents the results of the Shapiro–Wilk test and the one-sample t-test for the second axis.

Table (5): Results of the Shapiro–Wilk Normality Test and One-Sample t-Test for the Second Axis.

Overall mean	Standard deviation	Statistical value	Observed significance level	T-statistical value	Observed significance level
4.063	0.821	0.887	0.220	3.660	0.004

From Table 5, the following conclusions can be drawn:

- The observed p-value from the Shapiro–Wilk test is 0.220, which is greater than the significance level of 0.05, indicating that the data follows a normal distribution.
- The observed p-value from the one-sample t-test is 0.004, which is less than 0.05, thereby leading to a rejection of the null hypothesis.

This result confirms that:

- Cloud computing contributes to enhancing the security of financial data in Islamic banks in Libya, despite prevailing cybersecurity concerns.

The use of cloud computing systems reduces the operational costs of accounting processes in Libyan Islamic banks over the long term, despite the burden of high initial implementation costs.” Table 6 presents the descriptive statistics for this axis, including the mean scores, standard deviations, ranking of each statement, and their corresponding relative importance.

Table (6): Arithmetic Mean, Standard Deviation, Ranking, and Relative Importance of Statements in the Third Axis.

Num.	Axis Statements	Arithmetic Mean	Standard Deviation	Phrase Order	Importance Percentage
1	Cloud systems reduce the costs of running accounting operations.	4.38	0.92	1	87.5
2	The initial costs of cloud systems are a significant obstacle.	3.25	1.39	2	65.0
Total Axis		3.81	0.92	-	76.3

The results from Table 6 show that the mean values of the responses ranged between 3.25 and 4.38, with an overall mean of 3.81 and a relative importance of 76.3%. The highest-ranked statement was Statement 1: “Cloud computing reduces the operational costs of accounting processes,” which ranked first, with a mean score of 4.38 and a relative importance of 87.5%.

The use of cloud computing systems does not reduce the operational costs of accounting processes in Libyan Islamic banks over the long term, despite the burden of high initial costs. Since the number of data points is fewer than 30, the researcher applied the Shapiro–Wilk test to determine whether the data for this axis follows a normal distribution. Subsequently, a one-sample t-test was used to test the hypothesis. Table 7 presents the results of the Shapiro–Wilk normality test and the one-sample t-test for this axis.

Table (7): Results of the Shapiro–Wilk Normality Test and One-Sample t-Test for the Third Axis.

Overall mean	Standard deviation	Statistical value	Observed significance level	T-statistical value	Observed significance level
3.813	0.923	0.902	0.301	2.489	0.021

From Table 7, the following conclusions can be drawn:

- The observed p-value from the Shapiro–Wilk test is 0.301, which is greater than the significance level of 0.05, indicating that the data follows a normal distribution.
- The observed p-value from the one-sample t-test is 0.021, which is less than the significance level of 0.05, resulting in the rejection of the null hypothesis.

This confirms that:

- “The use of cloud computing systems reduces the operational costs of accounting processes in Libyan Islamic banks over the long term, despite the burden of high initial costs.”

Weak telecommunications infrastructure and a shortage of qualified personnel limit the effectiveness of implementing cloud computing systems in improving accounting operations in Islamic banks in Libya. Table 8 presents the descriptive statistics for this axis, including the arithmetic means, standard deviations, ranking of statements, and their respective relative importance.

Table (8): Arithmetic Mean, Standard Deviation, Ranking, and Relative Importance of Statements in the Fourth Axis.

Num.	Axis Statements	Arithmetic Mean	Standard Deviation	Phrase Order	Importance Percentage
1	Poor internet connectivity in Libya hinders the use of cloud systems.	3.88	1.25	2	87.5
2	Lack of technical skills among employees limits the effectiveness of cloud systems.	4.38	0.52	1	65.0
Total Axis		3.81	4.13	-	82.5

The results presented in Table 8 indicate that the mean responses for the items in this axis ranged between 3.88 and 4.38, with an overall mean of 4.13 and a relative importance of 82.5%. The highest-ranked item was Statement 2: “The lack of technical skills among employees limits the effectiveness of cloud systems,” which ranked first, with a mean score of 4.38 and a relative importance of 87.5%.

Weak telecommunications infrastructure and a shortage of qualified personnel do not limit the effectiveness of implementing cloud computing systems in improving accounting operations in Islamic banks in Libya. Since the sample size is fewer than 30 observations, the Shapiro–Wilk test was used to verify whether the data for this axis follow a normal distribution. After confirming normality, the one-sample t-test was applied to test the hypothesis. Table 9 presents the results of the Shapiro–Wilk normality test and the one-sample t-test for the fourth axis.

Table (9): Results of the Shapiro–Wilk Normality Test and One-Sample t-Test for the Fourth Axis.

Overall mean	Standard deviation	Statistical value	Observed significance level	T-statistical value	Observed significance level
4.125	0.694	0.931	0.521	4.583	0.001

From Table 9, the following conclusions are drawn:

- The observed p-value from the Shapiro–Wilk test is 0.521, which is greater than the significance level of 0.05, indicating that the data follows a normal distribution.
- The observed p-value from the one-sample t-test is 0.001, which is less than 0.05, leading to the rejection of the null hypothesis.

This result confirms that:

- Weak telecommunications infrastructure and the shortage of qualified personnel limit the effectiveness of implementing cloud computing systems in improving accounting operations in Islamic banks in Libya.

Key Findings:

- The implementation of cloud computing systems contributes to enhancing the efficiency of accounting operations, improving the accuracy of financial reporting, and reducing human errors in accounting practices within Libyan Islamic banks.
- Cloud computing contributes to enhancing the security of financial data in Islamic banks in Libya, despite prevalent cybersecurity concerns.
- The adoption of cloud systems leads to a long-term reduction in operational costs of accounting processes in Libyan Islamic banks, despite high initial implementation expenses.
- Weak telecommunications infrastructure and a shortage of qualified personnel significantly limit the effectiveness of cloud system implementation in improving accounting operations in Libyan Islamic banks.

Recommendations:

- Islamic banks in Libya should be encouraged to adopt cloud computing systems, given their proven impact on enhancing accounting efficiency, improving financial report accuracy, minimizing human errors, enhancing information security, and reducing operational costs.

- Greater emphasis must be placed on developing Libya's telecommunications infrastructure, which is critical for the successful implementation of cloud technologies across financial institutions.
- It is essential to invest in human capital development across the domains of information technology, software engineering, cybersecurity, and other relevant fields. Furthermore, banks should implement intensive training programs to upskill employees and improve their technical competencies in using cloud-based systems.

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