Modernising Clearing Processes: Essential Factors for the Successful Implementation of Electronic Cheque-clearing in Libyan Commercial Banks

Hani Nuri Rohuma[1], Asma. S. Alzwi, Mohamed M. ElMadani[3]

[1] Faculty of Economics, University of Benghazi, Qar Yunis Area, Benghazi, Libya
(Corresponding Author)

[2] Faculty of Economics, University of Benghazi, Qar Yunis Area, Benghazi, Libya

[3] Man-Made River Project, Al Hawary RD., Benghazi, Libya

Abstract

This research aimed to examine whether Libyan commercial banks have the necessary factors to effectively implement electronic cheque-clearing. The technology, infrastructure, organisational structure, and training are the factors that are considered in this research. A structured questionnaire is distributed to the employees in the electronic clearing department of the four biggest commercial banks in Libya, namely; Jumhouria Bank, National Commercial Bank, Wahda Bank, and Sahara Bank. These banks alone hold around 71.3% of the total assets of the Libyan banking industry. After receiving 217 valid responses for analysis, the researchers conducted the One-Sample Wilcoxon Signed Rank test, the Spearman correlation test, and the Samples Kruskal-Wallis test.

The results affirmed that there were statistically significant obstacles in the technology, infrastructure, and organisational structure factors, but not in the training. The infrastructure challenges were the first of the obstacles mentioned. Furthermore, there is a very strong and significant correlation between infrastructure factors and technical factors, as well as a strong and significant relationship between organisational structure factors and both technological and infrastructural factors. However, organisational structure, technology, and infrastructure factors have a moderately significant relationship with training factors. Ultimately, this research found that employees with different years of experience, as well as employees who have received training and those who have not, had different opinions about the essential factors required for electronic cheque-clearing to be implemented successfully in Libyan commercial banks, except for organisational structure where there are not significant differences between employees with different years of experience.

Keywords: Electronic cheque-clearing (ECC), Technological Factors, Infrastructure Factors, Organisational Structure Factors, Training Factors.

1. Introduction

The landscape of banks globally changed in a transformative way during the period marked by rapid digital evolution, leading to the acceptance of e-solutions by institutions (Banga, Beena,

Manchandani & Shukla, 2023). In this regard, electronic cheque-clearing (ECC) has been adopted as an essential part of banking systems' reengineering and modernization. The ECC is an automated process of cheque-clearing that is completely different from traditional or manual cheque-clearing (Ukoh, 2023). According to Jordan Payments and Clearing Company (2024), ECC transforms original paper cheques into images so that bank-to-bank financial transactions can be processed electronically. It involves computing the net balances that result from this process at a specific point in time and sending data, images, and cheque codes via the ECC department. Thus, the ECC transactions involve the electronic transfer of funds among banks through a central clearinghouse, usually a central bank. Hence, the integration of ECC systems is one such breakthrough that holds promise for faster processing and better security. Ndangoh (2018) stated that one of the biggest technological innovations of this time was the electronic clearing system, which replaced the antiquated manual clearing method and stimulated economic growth across the board. The majority of credit and debit transactions performed through the automated clearing house (ACH) are cleared, mostly on the same or next business day, due to this technology. This enables the safe, fast, and automated movement of funds electronically instead of using paper-based methods. According to Nacha (2024), the ACH network in the United States produced strong results in 2023 due to the ongoing deployment of same-day ACH and the ongoing rise in business-to-business payments, where the ACH network payments reached $80.1 billion in 2023, a 4.8% increase over the same period of the previous year.

According to the 2017 World Bank report entitled "Payment Systems Worldwide: A Snapshot," there is a global shift towards electronic modes of payment; this emphasises how ACH are changing to make cross-border transactions efficient and cost-effective in terms of time, safety, and economy. The report also indicates that sound principles are being established within existing systems, such as ACHs and cheque-clearing houses. Besides, the adoption of strong principles in established systems such as ACH and cheque clearinghouses is progressing steadily. Moreover, according to the report, 78 (68%) of the 115 countries that answered the World Bank's questionnaire reported that they have a cheque clearinghouse. Over half of high-income economies have these structures in place, compared to 90% of low-income nations. There are 37 countries without a cheque clearinghouse, most of which are in the high-income OECD countries and the ECA region.

The Situation of Libyan Banking

Libya, a country defined by its peculiar economic and geopolitical dynamics, exhibits a banking sector trying to adapt itself towards the changing world. The Central Bank of Libya (CBL) has played a major role in promoting e-payment solutions with ECC systems as drivers for economic stability and growth. The CBL is authorized by law to supervise the national payment system, based on the Bank's Law No. (1) of 2005 and the amendment issued on 16 May 2012 No. (46) of 2012 (CBL, 2016). According to Article 5 of the aforementioned law, the CBL allowed supervision over the national payment system, including clearing operations among banks subject to the provisions of this law and the establishment of governing rules for it (CBL, 2016). In this regard, CBL established the National Payment Systems Project in 2007 to enhance Libya's vital payment systems infrastructure. The project created important CBL-owned and controlled interbank clearing and settlement services in Libya, such as ACH, ECC, real-time

gross settlement system (RTGS), and SWIFT Gateway Service. Furthermore, CBL formed the National Payment Council (NPC) in 2018 to supervise the operations of payment systems. The NPC is comprised of several stakeholders, including commercial banks, the Libyan Insurance Company, and others (USAID, 2022). The CBL intends to implement ECCs in Libyan commercial banks to modernise the cheque clearance process, bring new services to clients, make operation processes easier than they currently are, and make cheque exchange easier.

The economic bulletin for the fourth quarter of 2023, issued by the CBL, shows the clearing values in Libya from 2009 to 2022 at the three branches of the central bank (Tripoli, Benghazi, and Sabah). The report also indicated that the ECC data had been included in the report since 2013 (CBL, 2023a). Hence, Table 1 below only displays the clearing values from 2013 to 2022. As depicted in the table, the total clearing values have not been published in the report since 2016, due to the split of the CBL into two main branches, the Eastern branch in Benghazi and the Western branch in Tripoli, each claiming to be the main central bank.

The disconnecting of the eastern branch from the ECC system was a move taken in 2014, during the Libyan war, by the government of the National Accord through the CBL of Tripoli. The reason behind that is to limit the financial resources available to Eastern authorities and prevent them from accessing government accounts and funds. This division, unfortunately, adversely affected the performance of the CBL and commercial banks, consequently impacting the clearing process. This separation has the effect of limiting the transactions between different financial institutions in the country. It is clear from the table, that since 2016, the total value of clearing (electronic and manual) has not been published in the report. Nevertheless, the electronic clearing reached its peak in 2022 as a result of the reunification of the CBL in both Benghazi and Tripoli. Even though since 2016 there have been no accurate statistics issued by the CBL regarding the total clearing values, it is noted that over the total clearance value, the ECC percentage was approximately 39%, 41%, and 51% in the years 2013, 2014, and 2015, respectively. Consequently, Libyan society deals extensively with manual clearing. This, in turn, led to an increased burden on Libyan commercial banks and the CBL, which might result in delays in settling the clearing on time.

Table 1 Clearing Values in Libya from 2013 to 2022

Year	Electronic Clearance Value (Millions of Libyan Dinars)	Total Clearance (Millions of Libyan Dinars)
2013	27,270.6	69,380.3
2014	26,560.3	64,257.0
2015	20,840.1	40,876.3
2016	13,421.7	N/A
2017	21,772.2	N/A
2018	40,923.8	N/A
2019	62,254.4	N/A
2020	49,832.5	N/A
2021	47,401.2	N/A
2022	85,523.6	N/A

Adopted from (CBL, 2023a)

Libyans are on the brink of digitizing their financial transactions in pursuit of the potentialities embedded within the ECC system. Yet, despite their promises of efficiency and automation, the incorporation of ECC systems into Libyan banks is characterised by multifaceted challenges that hinder their smooth operationalization. These challenges take various forms, including (1) technical, which is related to ECC technology and other supported systems; (2) infrastructural, which is related to the infrastructure of the clearing network, the provision of the Internet, and the communications network between banks; (3) organisational structure, which refers to the framework that the bank's management developed to divide and distribute tasks and responsibilities between different departments; and (4) training, which is related to the training and development of the employees in a clearing department. Understanding these challenges is thus vital in coming up with policies and structures that can surmount them, paving the way for the successful implementation of the ECC across the Libyan banking industry.

Research Problem

According to a report issued by the United States Agency for International Development in August 2022, the percentage of Libyans with bank accounts climbed from 66% in 2017 to 72% in 2021, where around 85% of Libyan employees are in the public sector and 70% of their salaries are paid directly into their bank accounts. Besides, 43% of Libyan employees in the private sector also receive their salaries in bank accounts. Since more than 80% of retail payment transactions in Libya are made in cash, employees withdraw cash from their accounts immediately (USAID, 2022). This withdrawal is due to (1) the low adoption of digital technologies; (2) the lack of confidence in the financial system; and (3) Libya has not completely operationalized the ACH and RTGS systems. Hence, the adoption of digital financial services in Libyan society is less than expected. Besides, Libya has faced numerous political and economic crises and cash shortages over the past decade, leading to banks' inability to meet high withdrawal demands for the available cash, resulting in a liquidity issue within the banks. This increased reliance on alternative payment sources, such as cheques.

However, according to the interview with Haitham Akgam, director of the banking supervision department of the CBL, in Benghazi on the 5th of April 2023, the major issue with dealing with manual cheques in Libya, which are more popular, lies in the clearing period to collect the cheque's value. This can take anywhere from 5 to 45 days, depending on the presence of the bank's branches involved, whether in one city or across different cities. Moreover, when using ECC, cheque-clearing between banks is not entirely automated and frequently has manual bottlenecks. Since the automatic cheque-reading technology is lacking, processing must be done manually, which increases processing time and increases the risk of error. Furthermore, Akgam added that cheques valued at more than LYD 250,000 must be manually cleared to prevent fraud and security issues. However, Al-Refai and Nawafleh (2014) and Ukoh (2023) found that the value of cheques presented for clearing has increased as a result of the adoption of an ECC in place of the manual clearing system. Thus, there is an increase in the amount and pressure of work in the clearing houses of commercial banks in Libya (USAID, 2022). Yet, Libyan commercial banks have recently begun adopting ECCs as a major stride in modernizing financial infrastructure. While striving for these technological developments, several challenges impede their smooth implementation and integration. Therefore, the main question of this research is:

"To what extent are the essential factors available for the successful implementation of the ECC within Libyan commercial banks?"

Essential factors such as technology, infrastructure, organisational structure, and training have been identified as encompassing the key challenges. Understanding these factors is paramount for comprehensively evaluating the barriers banks face in adopting ECC. By providing insights into the changing financial landscape in Libya, this research might be useful in guiding the implementation of ECC in that country. Especially mentioned that Asmah, Ofoeda and Gyapong (2018) clarified that no attempt has been made to emphasise the obstacles of ECC, despite its growing popularity in Africa. Therefore, this research undertakes to investigate to what extent the essential factors are available for the successful implementation of ECC in Libyan commercial banks. The factors that are examined in this research are (1) technological factors; (2) infrastructural factors; (3) organisational structure factors; and (4) training factors. Noting that this research examines technological factors separately from infrastructure factors to give a more accurate understanding of the challenges that banks may face concerning ECC. Technological factors are usually related to the clearing system and its accompanying systems. In contrast, infrastructural factors are considered more broad factors, as they include the infrastructure of the clearing network, the provision of the Internet, and the communications network between the bank and its branches, the bank, and the Central Bank of Libya.

2. Literature Review

The attention given to the adoption and implementation of ECC within banking institutions has made it relevant to focus on it in this research paper. The literature contains an assortment of studies that have investigated different dimensions of ECC tied up with banking. Nevertheless, there are numerous hurdles to implementing ECC, even if it can bring about some benefits for commercial banks operating in Libya. This section presents previous studies that are related to electronic clearing operations in the banking sector, concerning their implications and challenges.

For instance, Abukhzam and Lee (2010) argued that Libyan banks have not embraced and incorporated this innovation into their banking delivery strategy, even though they have recently acknowledged the advantages of e-banking technology in enhancing financial services. Rather, they still use conventional banking delivery methods, particularly paper-based branch networks, to provide the majority of their banking services and goods. This is mostly because bank employees are resistant to modern financial technology. This conclusion is supported by Mohamed (2013), who asserted that Libya's banking sector is currently falling behind and urgently needs reform to improve its banking system. The researcher added that the development of the Libyan banking system was being hampered by several factors, including an unreliable national telecommunications infrastructure, a lack of education among bank clients, a lack of technology awareness among bank employees, and the distance between bank branches and their headquarters.

Azzam, Arabeyyat, Alrawashdeh and Abu Rumman (2011) aimed in their study to identify the technical, managerial, and legal challenges associated with the implementation of ECC for

commercial banks in Jordan's Aqaba Special Economic Zone. The sample consisted of 19 commercial banks with Aqaba registrations. The one-way ANOVA T-test, F-test, and Cronbach's alpha were among the statistical tests that were employed. The results indicated that the technical challenges were the first obstacles, then managerial problems, and finally ligament problems at the last level. In the same country, Jordan, Daher (2018), in his Arabic study, aimed to determine the electronic clearing challenges that Jordan's banking industry faces. A questionnaire was created to meet the study's objectives. The results revealed that there were some obstacles to electronic clearing for Jordan's banking industry. These included, among others, the lack of foreign exchange clearing, frequent damage to banks' electronic clearing equipment, and unclear seals when examining cheque images.

Along similar lines, Wambua (2012) found that the primary obstacle to the implementation of the cheque truncation system is technological, with the remaining issues resulting from public misperceptions brought on by a lack of passion and insufficient communication from commercial banks. In the same vein, Deribe and Deribie (2013) found that the network problem is one of the major obstacles to successfully implementing the ECC in Ethiopia. The respondents to the researcher's questionnaire also indicated that one of the challenges facing ECC is inhumane labour practices. Furthermore, 15% of all respondents claimed that the issue with ECC is the delay in time. The delays in clearing cheques suggest that cheques are being left aside needlessly so that other customers can be served. Customers also encounter other issues with the cheque-clearing process, such as insufficient balances and bank confirmation requests. On the other hand, Asmah, Ofoeda and Gyapong (2018) affirmed that the primary issues facing ECC in Ghana are manual cheque reviews, insufficient bank collaboration, and security breaches at cheque printing firms.

The report "Libya Financial Sector Review" issued by the World Bank in 2020, clarified that although Libya did not have a single automated national payment system until quite recently, over the past few years, there has been a noticeable advancement in the architecture of the payment system. Payment components, including transfers or cheque-clearing, were housed in independent departments and lacked integration. Then, in 2007, CBL led the development of a national payment system. The project involved modernising the fundamental banking systems at the five major state banks (Jumhouria Bank, National Commercial Bank, North Africa Bank, Sahara Bank, and Wahda Bank) to enable bank-to-bank interaction and transfers. Thus, more than 85% of bank branches nationwide are currently linked to the main banking system at their corporate offices. As a result of the initiative, RTGS, ACH, ECC, and SWIFT were the four systems used for payments and settlements. However, there are still manual bottlenecks in the ECC. Since it does not have automatic cheque-reading technology, cheques must be moved through the system manually, which causes errors and takes time. The entire process is slowed considerably by non-automated branches, particularly those at state banks, and manual connections in the cheque-clearing network. With multiple initiatives under its belt, CBL appears to be getting closer to a solution for fully automating ECC.

Also, in his study, Alnaas (2021) aimed to determine the main obstacles facing Libyan commercial banks in adopting e-banking. The findings indicate that there are three main

obstacles: (1) electronic; (2) regulatory; and (3) cultural. According to this study, the following steps must be followed for Libyan commercial banks to successfully implement e-banking: need to raise bank employees' knowledge of contemporary banking technology. Also, an atmosphere that is conducive to this enterprise should be created by the government and offer sufficient technological support and instruction. Likewise, Trivedi and Sanchiher (2023) aimed in their research to identify the obstacles that are preventing the widespread implementation of digital payments in India. By using and analysing the secondary data, the results show that these obstacles include but are not limited to, low digital literacy, inadequate internet quality, bad connectivity, inadequate infrastructure, weak legislation governing disputes involving digital payments, etc.

By employing the ordinary least square method of analysis, Ukoh (2023) investigated how Nigerian deposit money institutions' total deposits were affected by their ECC. The results showed that deposit money banks' total deposits have increased dramatically since Nigeria implemented the automated cheque-clearing system. According to D'Andrea and Limodio (2023), the adoption of the real-time gross settlement system (RTGS) is accelerated by high-speed internet, which encourages banks to lend to the private sector, enhances interbank transactions, and reduces liquidity hoarding. Adopting RTGS has a tangible impact on businesses in nations with weak interbank markets already in place.

To summarise, previous studies have provided a coherent basis for understanding the impacts and potentials of ECC on banks. However, to implement ECC effectively, there are some key factors, which include technology, infrastructure, bank organisational structure, and training factors, among others. These factors need to be examined in a country like Libya, where cash and manual clearing are still widely used, as this would be vital to understanding the successful implementation of ECC by commercial banks in Libya. This research selected the factors mentioned above for several reasons. For instance, cheque-clearing will be negatively affected by any malfunction in the electronic clearing technology, defective equipment, or a hack into the system, in addition to the issue of power outages and inadequate infrastructure for communications and the Internet. Furthermore, obstacles that hinder the goal of implementing ECC will arise if the bank's organisational structure lacks flexibility, prompt decision-making, and departmental coordination and lacks employees with relevant training or experience.

Research Hypotheses

From the research problem and literature review, the hypotheses of this research are as follows:

$H_{O,1}$: There are essential technological factors for the successful implementation of the ECC within Libyan commercial banks.

$H_{O,2}$: There are essential infrastructural factors for the successful implementation of the ECC within Libyan commercial banks.

$H_{O,3}$: There are essential organisational structure factors for the successful implementation of the ECC within Libyan commercial banks.

$H_{O,4}$: There are essential training factors for the successful implementation of the ECC within Libyan commercial banks.

$H_{O,5}$: There is no significant relationship between technological, infrastructural, organisational structure, and training factors within Libyan commercial banks.

3. Data and Methodology

This research is based on primary data that is collected by using a structured questionnaire. The questionnaire was set based on the researchers' review of previous studies and some reports issued by the CBL and Libyan commercial banks. The questionnaire was divided into three main sections: (1) the personal information of the respondents, such as their qualifications, field of expertise, years of experience in the field of clearing, and training courses; (2) data related to the ECC in the bank, such as the type of clearing used, when the bank started the ECC, and the periods of updating the ECC in the bank; and (3) the axes of the study, which are represented in the essential factors of the successful implementation of ECC in Libyan commercial banks. These axes are as follows:

- First axis: related to the essential factors that are related to the technology (seven questions).
- Second axis: which includes the essential factors that are related to the infrastructure (seven questions).
- Third axis: related to the essential factors that are related to the organisational structure (seven questions).
- Fourth axis: related to the essential factors that are related to the training (seven questions).

Hence, the total number of axes is 28. The five-point Likert scale was employed in this study to meet its objectives. The researchers gave a number to each response. Number 1 is given for "strongly disagree" and 5 for "strongly agree." The numerical median of three is used as the foundation for the average review of the responses. This research also used positive and negative questions for data confidence, which can help the questionnaire respondents pay attention and the Likert scale data be sound.

The researchers took into account in distributing the questionnaire on so-called banking concentration. According to CBL (2023b), the degree of banking concentration means that the majority of banking activities are accounted for by a limited number of commercial banks, whether in terms of assets, deposits, credit, or equity size. In terms of the commercial banks' market share in Libya, by the end of the third quarter of 2023, out of a total of 20 banks included in the report, the assets of the four largest banks -Jumhouria Bank, National Commercial Bank, Wahda Bank, and Sahara Bank- were 71.3% of the total assets (total assets are LYD145.2 billion) of the Libyan banking industry (CBL, 2023b). Furthermore, the International Monetary Fund indicated that these four banks make up approximately 80% of total credit (IMF, 2023). Hence, the researchers distributed the questionnaire to clearing employees at these four large banks.

It is noted from Table 2 below that the total number of ECC employees in Jumhouria Bank, National Commercial Bank, Wahda Bank, and Sahara Bank reached 358 as of 31 December 2023. Although many questionnaires were distributed manually, there were some difficulties in reaching the clearing staff of numerous branches of Libyan commercial banks, especially since the branches of these banks are sprawling over the vast Libyan state. As a result, distributing the

questionnaire manually did not achieve the required number of responses, which forced the researchers to prepare an electronic questionnaire via Google Drive and reach the employees through WhatsApp groups, which are specific to clearing department employees of each bank. Therefore, this research took a longer time than expected to complete and collect the data. It is worth mentioning that the questionnaire was distributed to the four banks during the period from December 2022 to September 2023.

Table 2 Number of Clearing Employees in the Four Major Banks

No.	Bank	Number Employees*
1	Jumhouria Bank	150
2	National Commercial Bank	73
3	Wahda Bank	75
4	Sahara Bank	60
Total Employees		**358**

*Obtained from the Human Resources and ECC Departments of the related banks as of 31 December 2023.

The responses to the questionnaire were 229. However, 12 responses were cancelled due to a lack of seriousness in their answers. According to Krejcie and Morgan (1970), if the population size equals 360, the sample size should be at least 186. Therefore, the sample size for this research is considered appropriate and expresses the study population since the sample size is 217 employees, which represents about 61% of the total number of employees in the ECC department of the aforementioned banks.

In terms of data analysis, this research employs the following tests in line with the research objectives:

1. Cronbach's alpha test is applied to assess the reliability of Likert scale responses and ensure the internal consistency of the items.
2. The Kolmogorov-Smirnov test is used to examine the normality of the distribution of relevant continuous variables.
3. The descriptive statistics are applied by computing the weighted mean, the standard deviation, and the median.
4. The One-Sample Wilcoxon Signed Rank test is conducted to examine the research hypotheses related to the factors for the successful implementation of the ECC within Libyan commercial.
5. The Spearman correlation test is employed to examine the research hypothesis related to whether there is a significant relationship between technological, infrastructural, organisational structure, and training factors.

6. The Independent Samples Kruskal-Wallis test is employed to investigate whether there are statistically significant differences in the respondents' opinions about the essential factors for the successful implementation of ECC within Libyan commercial banks.

The One-Sample Wilcoxon Signed Rank test compares the value of the hypothesised median of 3 with the median value of the respondents. In non-parametric tests, it is preferred to use the median instead of the mean. This is why the One-Sample Wilcoxon Signed Rank test compares the median, not the mean. The other non-parametric tests that are conducted in this research are the Spearman correlation test and the Independent Samples Kruskal-Wallis. It is worth mentioning that the significant level of all the above tests is at 0.05.

4. Results and Discussion

4.1. Respondents' Characteristics

The results in Table 3 below show the characteristics of the 217 clearing employees who responded to the questionnaire. It is noted from the table that the majority of the respondents are male (61%). Also, most of those who filled out the questionnaire are graduates or post-graduates, which in turn indicates that they are well acquainted with the clearing issue. In terms of their field of expertise, the majority have experience in the fields of accounting, finance and banking, and business administration, while nine have expertise in IT and communication and three in statistics. Also, 99 employees out of 217 worked for Jumhouria Bank, while the rest were distributed among National Commercial Bank (44 employees), Al-Wahda Bank (45 employees), and Sahara Bank (29 employees). Only 29% of the respondents have experience of less than 10 years, while the others (71%) have experience of more than 10 years. That is also another good signal that the respondents to the questionnaire have good experience in the cheque-clearing department.

Furthermore, 127 employees stated that they have received a training course in the field of clearing. However, only 20 employees are not satisfied with this training, while 107 are either satisfied or partially satisfied. Only two employees reported that the bank only deals with manual clearing. In contrast, 7 employees reported that the bank only deals with electronic clearing, while the majority of employees (208) reported that the bank deals with both manual and electronic clearing.

Furthermore, of the employees' answers to the question regarding when the bank began dealing with electronic clearing, 194 out of 215 (2 answers are excluded since they state that the bank only uses manual clearing) informed that electronic clearing started 5 years ago and more. Finally, in the answers about when banks updated the electronic clearing system, 125 reported that the bank updated the system more than 2 years ago, and 59 stated that the bank did not update the system. On the other hand, 12 stated that the renewal happened in less than a year.

Table 3 Respondents' Characteristics

Respondents Characteristics	No.	(%)
Gender		
Male.	133	61%
Female.	84	39%
Qualification		
Less than a bachelor.	5	2%
Bachelor.	158	73%
Master's Degree.	48	22%
Ph.D.	6	3%
Field of expertise		
Accounting.	94	43%
Business Administration.	40	18%
Economy.	19	9%
Finance and Banking.	52	24%
Statistics.	3	1.5%
IT.	6	3%
Communication.	3	1.5%
Working at:		
Jumhouria Bank.	99	46%
National Commercial Bank.	44	20%
Al-Wahda Bank.	45	21%
Sahara Bank.	29	13%
Years of experience in the field of clearing		
Less than 5 years.	22	10%
From 5 to less than 10 years.	42	19%
From 10 and less than 15 years.	40	18%
15 years and more.	113	52%
Have you received training courses in the field of electronic clearing systems?		
Yes.	127	59%
No.	90	41%
If you received a training course, do you think it helped you at work?		
Yes.	74	58%
Partial.	33	26%
No.	20	16%
The clearing system in the bank is:		
Electronic.	7	3%
Manual.	2	1%
Manual and Electronic.	208	96%
When does the bank use electronic clearing?		
Less than 5 years.	21	10%

From 5 to less than 10 years.	165	77%
10 years and more.	29	13%
The bank updates the electronic clearing system every:		
Less than 1 year.	12	6%
Between 1 - 2 years.	21	10%
More than two years.	125	58%
Does not update.	59	27%

4.2. Reliability and Normality Tests

As mentioned earlier, the reliability of the Likert scale is evaluated using Cronbach's alpha test, while the Kolmogorov-Smirnov test is used to investigate the normal distribution of the answers. Table 4 below presents the results of Cronbach's alpha test and the Kolmogorov-Smirnov test. In Cronbach's alpha, the results indicate that the overall alpha value of this research is 0.88, while its value in the variables is between 0.79 and 0.84. According to Taber (2018), if the alpha value is between 0.76 and 0.95, it is considered fairly high. Thus, the reliability of this research is fairly high. This indicates that there is an 88% chance that the same results will be achieved if the questionnaire is distributed to a different sample at a different time. On the other hand, since the results of the Kolmogorov-Smirnov test indicate that all p-values are less than 0.05, the replies to the answers are not normally distributed. Therefore, this research employs non-parametric tests, such as the One-Sample Wilcoxon Signed Rank and Independent Samples Kruskal-Wallis tests.

Table 4 Results for Reliability and Normality of the Answers

Essential Factors	Cronbach's Alpha		Kolmogorov-Smirnov[a]		
	No. Questions	Value	Statistic	df.	Sig.
Factors related to Technology.	7	0.79	0.09	217	**0.00***
Factors related to Infrastructure.	7	0.84	0.11	217	**0.00***
Factors related to Organisational structure.	7	0.84	0.09	217	**0.00***
Factors related to Training.	7	0.80	0.09	217	**0.00***
Overall	**28**	**0.88**			

*Significant at a 0.05 level

4.3. Testing of the Hypothesis

It is worth mentioning that in computing the weighted mean, standard deviation, and median for the total questions, the researchers took into account the type of question, whether it was a positive or negative statement.

4.3.1. Technological Factors:
$H_{O,1}$: *There are essential technological factors for the successful implementation of the ECC within Libyan commercial banks.*

Table 5 below shows the results of the One-Sample Wilcoxon Signed Rank test that is related to the bank's technological factors. It is evident from the results that the median is 2.71, which is less than the hypothesised median value of 3, with a p-value equal to 0.00, hence, there are statistically significant differences between the median of the respondents and the hypothesised median. Accordingly, the results emphasise that there is some weakness in the essential factors that are related to the bank's technology for the successful implementation of ECC within Libyan commercial banks; therefore, there are some obstacles related to the bank's technology. Additionally, by checking the items within the technological factors, the results show that all p-values are less than 0.05, and the most challenging face for banks for the successful implementation of ECC within the Libyan commercial banks is that the electronic clearing system has a lot of malfunctions, followed by the banks not providing all digital systems associated with the electronic clearing system for all clearing staff. According to Abukhzam and Lee (2010), Libyan banks continue to employ conventional financial methods, including branch networks that rely on paper. The main reason for this is that bank employees are averse to using modern financial technology. Mohamed (2013) found that there is also a lack of technology awareness among bank employees in Libya. Along similar lines with the results of this research, Azzam et al. (2011), Wambua (2012), and Daher (2018) concluded in their studies that technical challenges are the first obstacles to the implementation of ECC for commercial banks. Besides, Alnaas (2021) asserted that technological obstacles are one of the main obstacles facing Libyan commercial banks in adopting e-banking. Therefore, importance must be given to solving any technical problems related to ECC to ensure the effective performance of electronic clearing in Libyan commercial banks.

Table 5. Results of One-Sample Wilcoxon Signed Rank test about Technological Factors.

	Essential Factors Related to Technology	Mean	Std.	Median	Significant
	Total	*2.702*	*0.701*	*2.71*	*0.00**
1	Banks allocate the necessary finance for the technology development related to the electronic clearing service.	3.53	1.07	4.00	**0.00***
2	There is a trend towards the development of technology related to the electronic clearing service.	2.85	1.30	3.00	**0.04***
3	The electronic clearing system is complex and difficult to use by clearing staff.	2.39	0.87	2.00	**0.00***
4	There is a possibility of breaching the electronic clearing system.	3.44	0.93	3.00	**0.00***
5	There is a possibility of passing counterfeit cheques through the electronic clearing system.	3.86	0.91	3.00	**0.00***
6	The electronic clearing system has a lot of malfunctions.	4.23	1.01	5.00	**0.00***
7	Digital systems associated with the electronic clearing system are provided for all clearing staff.	2.45	1.20	2.00	**0.00***

(Test value = 3, *Significant at a 0.05 level)

4.3.2 Infrastructural Factors:

$H_{O,2}$: *There are essential infrastructural factors for the successful implementation of the ECC within Libyan commercial banks.*

Table 6 below presents the results of the One-Sample Wilcoxon Signed Rank test that is related to infrastructure factors. The results show that the median is 2.28, which is less than the hypothesised median value of 3, with a p-value equal to 0.00. Thus, there are statistically significant differences between the median of the respondents and the hypothesised median. As a result, there is some weakness in the essential factors that are related to the infrastructure for the successful implementation of ECC within Libyan commercial banks, and hence, there are obstacles related to the infrastructure. Furthermore, with a review of the infrastructure factors, the results reveal that all p-values are less than 0.05, except for item number 2. Therefore, the disconnection problems between the clearing centre of the bank and its branches, as well as between the clearing centre of the bank and the clearing centre of the Central Bank of Libya, pose the biggest obstacles related to infrastructure factors that hindered the successful implementation of ECC in the Libyan commercial bank. This is followed by the fact that the bank and central bank do not provide the necessary infrastructure and alternative infrastructure to facilitate the electronic clearing system for the employees. These results are in line with the results of Wambua (2012), and Deribie and Deribie (2013), who found that there are infrastructure challenges regarding banks' electronic clearing. Trivedi and Sanchiher (2023) concluded that there are inadequate infrastructure challenges for implementing digital payments in India. These results are also supported by John and Roitimi (2014) and Teka (2017).

Accordingly, a lack of adequate bank infrastructure might constrain the successful implementation of ECC in Libyan commercial banks. It is thus important to address these obstacles, which can enhance efficiency by enhancing the ECC processes, leading to an overall improvement in banking operations, including customer satisfaction.

Table 6. Results of One-Sample Wilcoxon Signed Rank test about Infrastructure Factors.

	Essential Factors Related to Infrastructure	Mean	Std.	Median	Significant
	Total	*2.43*	*0.77*	*2.28*	*0.00**
1	The bank provides the necessary infrastructure to accomplish the tasks of the electronic clearing staff.	2.64	1.25	2.00	**0.00***
2	There is a network connection between bank branches that allows rapid completion of the electronic clearing service.	3.13	1.26	3.00	0.08
3	There are problems of disconnection between the clearing centre of the bank and its branches.	4.40	0.93	5.00	**0.00***
4	There are problems of disconnection between the clearing centre of the bank and the clearing centre of the Central Bank of Libya.	4.43	0.91	5.00	**0.00***
5	The Central Bank of Libya provides all necessary infrastructure facilities for the electronic clearing system.	2.38	0.99	2.00	**0.00***
6	The bank has an alternative infrastructure in the case of a malfunction of the basic infrastructure.	2.28	1.08	2.00	**0.00***
7	There is technical support within the bank to face any malfunctions in the electronic clearing system.	3.39	1.07	4.00	**0.00***

(Test value = 3, *Significant at a 0.05 level)

4.3.3 Organisational Structure Factors:

$H_{O,3}$: *There are essential organisational structure factors for the successful implementation of the ECC within Libyan commercial banks.*

The organisational structure can be simply defined as the structure that is designed by the organization's management to divide and distribute tasks and responsibilities between different departments. The results of the One-Sample Wilcoxon Signed Rank test that are related to infrastructure factors are shown in Table 7 below. With a p-value of 0.00, the findings indicate that the median is 2.85, which is lower than 3. Therefore, the differences between the respondents' median and the hypothesised median are statistically significant. Consequently, there are challenges in the organisational structure for the successful implementation of ECC within Libyan commercial banks due to some weaknesses in those essential factors. Additionally, all of the organisational structure factor items, aside from item number 4, have p-values less than 0.05. The biggest obstacle in this regard is that the bank's intranet lacks transparency when it comes to the distribution of banking information, which would not facilitate prompt decision-making by clearing staff. Furthermore, there was no corresponding

reorganization of the clearance department following the adoption of digitalization. The lack of employees in the clearing department as well as the bank's organisational structure, which is not constantly adjusted to conform to the bank's digital transformation initiatives, are the other two obstacles. However, it is expected that the more the bank employs technology, the more the organisational structure will change in a way that simplifies procedures and decision-making, and thus, it will also have a positive effect on ECC. Evidence from Mirmasoudi, Farjami, and Pourebrahimi (2012) and Rahmanseresht, Mahmoudi, and Ghaderi (2016) emphasizes a strong correlation between information technology influence and organisational structure. The results collected indicated the role that information technology plays in simplifying the organisational structure of a bank, decreasing bureaucracy, and centralizing processes.

Hence, the efficient integration and operation of ECC processes may be hampered by many factors related to organisational structure such as inflexible hierarchies, bureaucratic procedures, or a lack of cooperation within organisational divisions. To improve the environment and facilitate the deployment and operationalization of ECC systems in Libyan banks, the organisational structure of Libyan commercial banks must be reviewed.

Table 7. Results of One-Sample Wilcoxon Signed Rank test about Organisational Structure Factors.

Essential Factors Related to Organisational Structure	Mean	Std.	Median	Significant
Total	*2.78*	*0.86*	*2.85*	*0.00**
1 There is transparency in the dissemination of banking information on the bank's intranet to enable quick decision-making by clearing staff.	2.63	1.17	2.00	**0.00**
2 Ease of administrative communication between the branches of the bank and the electronic clearing centre.	3.34	1.13	4.00	**0.00**
3 There is a precise job description of the tasks and work assigned to the clearing staff	3.35	1.22	4.00	**0.00**
4 There is flexibility in making decisions in the clearance department.	3.08	1.10	3.00	0.25
5 The clearance department was restructured after the adoption of digitalization commensurate	2.37	1.20	2.00	**0.00**
6 There is a shortage of staff in the clearance department.	3.45	1.33	4.00	**0.00**
7 The bank's organisational structure is periodically developed to align with the bank's digital transformation programs.	2.12	1.26	2.00	**0.00**

(Test value = 3, *Significant at a 0.05 level)

4.3.4   Training Factors:

$H_{O,4}$: *There are essential training factors for the successful implementation of the ECC within Libyan commercial banks.*

Table 8 below displays the findings from the One-Sample Wilcoxon Signed Rank test that are relevant to determining training and development. The results show that the median is 3, which is the same as the hypothesised median value of 3, with a p-value of 0.281. As a result, there is no statistically significant difference between the median of the respondents and the hypothesised median value. Thus, there are no serious challenges in terms of training for the successful implementation of ECC within Libyan commercial banks.

All items that are connected with determining training have a p-value less than 0.05, except item 6. Although these items are generally positive, there are some training-specific obstacles that banks still face, such as the fact that training courses related to electronic clearance are often short and intensive, and employees from other departments are trained in courses related to electronic clearing systems. The aforementioned point may be due to the bank's policy of rotating employees between various positions in the bank. Alnaas (2021) emphasized the need to raise bank employees' knowledge of contemporary banking technology in Libya. Especially since there is a lack of awareness of banking technology among customers and bank employees in Libya (Mohamed, 2013). Moreover, according to the World Bank (2020), difficulties in cheque-clearing may arise from needing more employees to process them.

The absence of any significant obstacles related to training to the successful implementation of ECC within Libyan commercial banks means that factors such as inadequate training programs, insufficient skill development initiatives and low employee proficiency levels may not necessarily hinder the adoption and utilization of ECC systems in this setting. It might at first sound strange yet it could mean that banks have effectively addressed training-oriented concerns or other reasons exert more influence on the implementation process. For instance, Libyan banks might provide adequate training for a large number of their employees, whether inside or outside Libya. Also, this may indicate that employees have received sufficient courses in the field of ECC and that they believe that training has no real obstacles compared to other obstacles. However, further investigation and analysis are necessary to explain why these findings are not significant and thus provide an avenue for improving effectiveness and efficiency regarding the Libyan banking system's e-cheque initiatives.

Table 8. Results of One-Sample Wilcoxon Signed Rank test about Training Factors.

	Essential Factors Related to Training.	Mean	Std.	Median	Significant
	Total	*2.02*	*0.68*	*3.00*	*0.281*
1	The bank's management trains the modern digital systems for all staff in the clearance department.	3.35	1.07	4.00	**0.00***
2	The training contributed to reducing the errors of the electronic clearing.	3.38	1.00	4.00	**0.00***
3	When developing digital clearing systems, staff are trained on how to work with them.	3.59	0.90	4.00	**0.00***
4	Employees who are unrelated to the clearance work are often nominated for training courses related to electronic clearing systems.	3.85	1.04	4.00	**0.00***
5	Training courses related to electronic clearance are often short and intensive.	4.45	0.73	5.00	**0.00***
6	The training courses given to electronic clearing staff did not achieve the bank's desired goal.	3.12	1.09	3.00	0.06
7	Specialized experts from inside the bank are used to give training courses in the field of electronic clearing systems.	3.61	1.20	4.00	**0.00***

(Test value = 3, *Significant at a 0.05 level)

4.3.5 Correlation Test

$H_{O,5:}$ *There is no significant relationship between technological, infrastructural, organisational structure, and training factors.*

This research also investigates whether there is a significant relationship between technological, infrastructural, organisational structure, and training factors for the successful implementation of ECC within Libyan commercial banks. By employing the Spearman correlation test, the results are presented in Table 9 below. It is worth mentioning that the correlation coefficient has a value between +1 and -1. A strong relationship between the factors is presented if the correlation coefficient is +1. If it is -1, a strong negative relationship is present. If it is 0, nevertheless, that indicates that there is no relationship between the factors. According to Evans (1996), if the correlation coefficient is equal or bigger than 0.4 and smaller than 0.6, the correlation is moderate, and if it is equal or bigger than 0.6 and smaller than 0.8, then the correlation is strong, while if it is equal or bigger than 0.8, then the correlation is very strong.

By screening the results in the table, the results were generally different, but they all confirmed the existence of a statistically significant relationship between the various basic factors. There is a very strong and significant relationship between infrastructure factors and technological factors (correlation coefficient = 0.829). This very strong correlation might be because technology is, to some extent, considered part of infrastructure. Thus, development in electronic clearing infrastructure will, in turn, have a positive effect on technological factors. Furthermore, there is a

strong and significant relationship between organisational structure factors and both technology and infrastructure factors. Therefore, any infrastructure and technology development will strongly affect the bank's organisational structure concerning ECC. Finally, there is also a significant correlation between training factors on the one hand and technological factors, infrastructure factors, and organisational structure factors on the other hand, but this correlation is moderate. Thus, despite the importance of training at all levels, especially in the banking field, its relationship with other factors is less important compared to technology, infrastructure, and organisational structure factors.

Table 9. Results of the Correlation test between the Different Essential Factors

	Technological Factors	Infrastructure Factors	Organisational Structure Factors	Training Factors
Technological Factors	1	0.829*	0.682*	0.590*
Infrastructure Factors	-	1	0.671*	0.585*
Organisational Structure Factors	-	-	1	0.524*
Training Factors	-	-	-	1

*Significant at a 0.05 level

4.4. Differences in the Respondents' Opinions

Finally, this research also examines whether there are significant differences between the respondents in terms of the essential factors that are related to the successful implementation of ECC within Libyan commercial banks. The Independent Samples Kruskal-Wallis test is conducted between employees with different years of experience in the field of ECC and also between employees who received and have not received training courses in the field of electronic clearing systems.

In terms of experience years, except for organisational structure, the results in Table 10 affirm that all p-values are less than 0.05, which indicates that there are statistically significant differences in the median answers between employees with different years of experience in terms of the essential factors to the successful implementation of ECC within Libyan commercial banks. Therefore, employees with different years of experience have different perceptions regarding these factors. However, the insignificant differences in organisational structure might be due to the relative stability of the bank's organisational structure and employees' adaptation to it. This structure requires a decision from higher authorities in the bank to change it. Therefore, it does not change as easily over time as a change in technology or training.

Concerning the training, the results also asserted that there are statistical differences in the answers between employees who received training and those who have not, in terms of the essential factors to the successful implementation of ECC within Libyan commercial banks. This might be because employees who have received training courses in ECC are expected to have

higher confidence and ability to deal with it compared to employees who have not received training courses. This indicates the importance of training in this field.

Table 10. Results of the Differences in the Respondents' Opinions

	Total Number n (%)	Technological Factors (p-value)	Infrastructure Factors (p-value)	Organisational Structure Factors (p-value)	Training Factors (p-value)
Experience Years					
Less than 5 years	22 (10%)				
From 5 to less than 10 years	42 (20%)				
From 10 and less than 15 years	40 (18%)	**0.00***	**0.00***	0.08	**0.00***
More than 15 years	113 (52%)				
Received Training					
Yes	127 (59%)	**0.00***	**0.01***	**0.00***	**0.00***
No	90 (41%)				

*Significant at a 0.05 level.

5. Conclusion

The main objective of this research was to investigate whether commercial banks in Libya have the essential factors for the successful implantation of ECC. The factors that are analysed in this research are technological, infrastructure, organisational structure, and training factors. This research relied on a questionnaire designed for this purpose, which was distributed to employees in the electronic clearing department of the four largest commercial banks in Libya. These banks are Jumhouria Bank, National Commercial Bank, Wahda Bank, and Sahara Bank. After conducting statistical analyses for the 217 obtained responses, this study found that there were statistically significant obstacles in technology, infrastructure, and organisational structure, while for training, the obstacles were not statistically significant. The infrastructure challenges were the first of the obstacles mentioned. Therefore, commercial banks and the CBL must give more attention to making improvements in the electronic clearing system and any other services related to it, as well as amending the organisational structure of commercial banks, so that they are compatible with the development of technology.

Furthermore, a strong and significant relationship is found between organisational structure factors and both technological and infrastructural factors, as well as a very strong relationship between infrastructure factors and technological factors. Although this relationship is moderate, there is also a significant relationship between the factors related to infrastructure, technology, and organisational structure on the one hand and training on the other. Finally, this study demonstrated that employees with varying years of experience had varying perspectives on the key factors necessary for a successful implementation of ECC throughout Libyan commercial

banks, except for organisational structure. Furthermore, statistical differences exist in the responses provided by employees who have undergone training and those who have not.

Ultimately, this paper has highlighted the numerous challenges that surround taking up and implementing ECC systems in Libyan commercial banks. The findings emphasise the importance of technology, infrastructure, and organisational structure as crucial factors to achieve good results in this regard. The major challenges found within these sectors highlight the need for strategic interventions and targeted remedies to address issues like technological readiness, infrastructural inadequacies plus organisational misalignment. Although training was identified as a non-significant challenge, its potential role in easing transitions towards electronic cheque clearance systems should not be underestimated thus calling for continued focus on employee training initiatives. In the end, the results of this research agree with the statement of USAID (2022) that even with the CBLs and the digital financial services sector's recent advancements, Libya still faces many shortcomings and difficulties. These constrain the financial sector's ability to expand further, which has an impact on financial intermediation and the adoption of digital financial services.

In summing up, therefore, this paper gives some necessary information needed by policymakers' banking professionals and all stakeholders who are interested in navigating through the complexities involved in modernizing cheque-clearing processes so that efficiency and innovation can be introduced in Libya's banking sector.

Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest.

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