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Investigating Blockchain Implementation in Egyptian Banking Industry

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المستخلص

الغرض - يهدف البحث إلى دراسة تأثير تقنية Blockchain على القطاع المصرفي المصري. تم تطوير الإطار النظري لهذا البحث وفقاً لمنظور نظرية انتشار الابتكار (DOI).

التصميم / المنهجية / النهج - تم إجراء منهجية استطلاع استكشافية عبر الإنترنت في سبتمبر ٢٠٢٢ ، تلاها تطبيق تحليل SWOT (القوة والضعف والفرص والتهديد) وتحليل المعيار على البنك الأهلي المصري (NBE) مقابل البنك التجاري الدولي (CIB).

النتائج - خلصت النتائج الرئيسية إلى أن معظم البنوك المصرية في مرحلة التخطيط لاعتماد Blockchain. قامت معظم البنوك بتعيين فرق تتعاون مع قسم تكنولوجيا المعلومات (IT) لعملية البدء بغض النظر عن التكلفة الوسيطة المرتفعة. على وجه التحديد ، وخلصت النتائج إلى أن معظم البنوك في المرحلة الأولى من اختبار اختراق Blockchain ، والذي يركز على جمع المعلومات وصياغة التهديدات، وأن اهتمام البنوك بـ Blockchain يرجع إلى سهولة مراقبة المعاملات. وقد أثرت الجائحة COVID-19 بشكل أساسي على القنوات الرقمية لخدمة العملاء التي عززت اعتماد Blockchain وغيرها من تقنيات Fintech. وقد أظهرت نتائج SWOT أن البنك الأهلي المصري أفضل من البنك التجاري المصري في التحليل الداخلي (القوة والضعف) بينما التحليل الخارجي (الفرص والتهديدات) CIB فان البنك التجاري المصري أفضل من البنك الأهلي المصري.

الأصالة - تقدم هذه الدراسة مساهمة في الأدبيات المحاسبية في جوانب مختلفة. تم استخدام إطار تقييم Fit للحصول على نظرة ثاقبة حول حالة Blockchain في البنوك المصرية ، إلى جانب الاتجاهات والآفاق المستقبلية. علاوة على ذلك ، طور الباحثون تحليل (SWOT) والتحليل المعياري الذي يقيم ويوضح الجوانب المختلفة لـ Blockchain وفقاً للأدبيات ونتائج المسح.

الآثار البحثية - تؤثر تقنية Blockchain بشدة على المجتمع والاقتصاد المصري حيث يمكنها تحويل الخدمات المصرفية بتكلفة أقل ، مع حماية عالية وسرعة. يشجع هذا البحث الحكومة والبنك المركزي المصري على توفير الوعي والدعم لتكنولوجيا Blockchain للقطاعات المالية من خلال التدريب والمساعدات المالية لتلبية رؤية ٢٠٣٠ المصرية.

الكلمات الدالة: Blockchain ، نظرية انتشار الابتكار (DOI) ، SWOT ، COVID-19

Investigating Blockchain Implementation in Egyptian Banking Industry

Abstract

Purpose - The research aims to examine the influence of Blockchain technology on the Egyptian banking sector. The theoretical framework of this research is developed according to the Diffusion of Innovation (DOI) theory perspective.

Design/methodology/approach - An exploratory online survey methodology was conducted in September 2022, followed by applying both SWOT analysis (strength, weakness, opportunities, and threat) and benchmark analysis on National Bank of Egypt (NBE) against Commercial International Bank (CIB).

Findings- The main findings concluded that most Egyptian banks are in the planning phase of Blockchain adoption. Most of them have assigned teams cooperating with the Information Technology (IT) department for the adoption process regardless of its high intermediary cost. Specifically, most banks are in the first phase of Blockchain penetration testing, which focuses on information gathering and threat molding. Banks are interested in Blockchain for its ease of monitoring transactions. Meanwhile, COVID-19 mainly affected digital channels for customer service that enhanced the adoption of Blockchain and other Fintech technology. The results show that from strength and weaknesses (inner) prospective, NBE is better than CIB. While from the external (opportunities and threats) CIB is better than NBE.

Originality -This study offers contribution to the accounting literature in different aspects. Fit assessment framework has been used to gain insights into the status of Blockchain in the Egyptian banks, besides future trends and perspectives. Moreover, the researchers have developed (SWOT) analysis and benchmark analysis that evaluate and clarify the different aspects of Blockchain according to the literature and the survey results.

Research implications – Blockchain strongly impacts Egyptian society and the economy as it can transform banking services at a lower cost, with high protection and speed. This research encourages the government and the CBE to provide awareness and support for Blockchain technology to financial sectors through training and financial aids to meet the 2030 Egyptian vision.

Key words

Blockchain, Diffusion of Innovation theory (DOI), SWOT, COVID-19

Paper type: Research paper

1. Introduction

The recent development of digital technology has created many attempts to take advantage of it in different industries, especially the banking industry. The pandemic negatively affected the banking industry by the early start of 2020. Most worldwide banks are working on digitizing their systems through financial technology (FinTech) to cope with globalization and the high customer streams. However, banks could not deal with the shut-down situation in most countries, and the impact of covid-19 highly affected them economically and financially.

Blockchain is one of the emerging innovations that has revolutionized information storage and circulation safely and rapidly. blockchain was introduced recently to solve some of the banking industry's current problems. Bank modifications and improvements faces obstacles that might differ from country to country such as increased costs of operations, increased fraudulent susceptibility, and transparency challenges (Sharma, 2020).

Blockchain is a new transformer for banking services at lower cost and high protection and speed. It facilitates money transfer, leverages different financial services, provides intelligent contracts, and digitalizes various banking transactions (Osmani et al., 2020). It, therefore, introduces the ability to improve related stakeholders' accountability, confidence, and privacy concerns.

Egyptian banks face great pressure to adopt digitalization to cope up with the current wave. Some Egyptian banks have already switched to blockchain technology such as the National Bank of Egypt (NBE), one of Egypt's largest bank, which has announced its deal with RippleNet Blockchain for cross border payments with Lulu International Exchange last year, and HSBC-Egypt has issued R3's Corda blockchain using Distributed Ledger Technology.

The goal of blockchain technology is to produce a decentralized ledger that is transparent and publicly accessible to create confidence in an unsafe world independently of a third party. The ledger contains the blockchain's mutually agreed-upon status, as well as a permanent list of all previous transactions. In addition, other inventions may be underused (Garg et al., 2021).

Currently, blockchain is applied for cryptocurrency financial transactions and linking them with conventional banking and financial systems. Blockchain

technology is capable of transforming the entire financial industry, and it is expected to overwhelm banking and financial systems in the near future with its innovations and creativity that match the current business and market needs.

However, Central Bank of Egypt (CBE) accepts cashless activities but declares clearly the prohibition of cryptocurrencies, promoting, implementing related activities, trading or, establishing or operating platforms for their trading according to Article 206 of the CBE and Banking System Law promulgated by Law No. 194 of 2020.

Nevertheless, as blockchain has created chances for companies, it is crucial to recognize that there will be several difficulties and uncertainties in the technical, regulatory, and adoption-related fields. Recent occurrences, such as the theft of digital currency and cyber security breaches, have confirmed the significant level of risk involved with the usage of blockchain technology in finance and banking. Therefore, this research explores the application of blockchain in both current and potential banking systems.

2. Background

Since its inception, the banking business has provided customers with trust for every financial transaction, including bank deposits, trading, custody, insurance, clearing, and settlement. Banks are in charge of the ledger and accounting systems which they charge consumers for, and customers pay for security and confidence.

Today, banks are facing a threat from FinTech start-ups using cutting-edge technology and blockchain with their speedier, more transparent, and less expensive services. The banking industry's work structure is monotonous, time-consuming, and expensive. They have already snatched up considerable market share in the payment business. With the ever-increasing competitiveness of the market, blockchain has become a highly essential issue for banks all over the world. To address these issues, big institutions, including central banks, are looking at integrating blockchain technology into their current business structures, which has enabled banks to reduce back office operational expenses (Casey et al., 2018).

Blockchain technology aims at managing databases among a massive number of users and distributing these data in groups of transactions called "block" (Sharma, 2020). Blockchain advocates decentralized distributed systems and consists of

chained linear sequence blocks connected at nodes; each block consists of a cryptographic hash of the previous block that ensures verification of the security of all blockchain. Each block contains a timestamp to show the blockchain creation time. The information in the hash is impossible to change because it is generated automatically. The more blocks in the chain, the safer and more reliable the Blockchain is.

To learn how blockchain operates, it is necessary to understand basic concepts: a network of nodes, tokens, a structure, a consensus process, and rules. Each participant (computer) in a network is referred to by the network of nodes. The nodes are interconnected, and the validity of transactions is verified. The higher the relation between nodes, the more robust the network is. Tokens referred to as digital currencies or cryptocurrencies reflect value ownership. It can represent cash or assets of any sort and can be used for value exchange. The blockchain structure is then ordered by a sequence of transactions. To form a blockchain, each block connects (Krause & Tolaymat (2018).

The main effects connected to the banking industry are, firstly, cross-border payments: the safest and most dependable method regardless of its time-consuming and expensive procedures (Isaksen, 2018; Guo & Liang, 2016). Secondly, Trade finance Provides payment assurances and credit support for commercial transactions. One of the most common forms of business financing is the use of letters of credit (Gupta & Gupta 2018).

Thirdly, Know your customer (KYC) refers to the bank's a duty and responsibility to record the customer's information and make sure that it is verified before beginning any financial transactions. A legislative framework governs KYC to prevent money laundering and terrorism financing (ECB, 2018). It improves the efficiency of the operation and eliminates the need for repetitive tasks (Gupta & Gupta, 2018; Guo & Liang, 2016).

Fourthly, capital markets which is considered a complicated process, and its account settlement that might take a long time. In the capital markets, a wide range of intermediaries are active, including banks (primarily investment banks), brokers, investors, credit agencies, and others. Currently, these participants keep their own ledger and make the required adjustments. This process takes time and money (Gupta & Gupta, 2018).

If the cooperating businesses utilize a common blockchain platform, the transaction may be carried out in real-time with more efficiency and transparency. It might be utilized to eliminate the third party while maintaining the KYC procedure. Additionally, initial public offerings can use (IPOs) Finally, blockchain has the ability to automate reporting and save a substantial amount of time and money. This is relevant to financial reporting and compliance. Blockchain technology can remove all paper-based processes. The transactions may be updated and recorded automatically. The regulatory board's and the banks' tasks would both be made simpler by this. The transactions can be traced, which can help with attempts to combat money laundering (Petrov, 2019).

The DoI theory tries to explain how, why, and to what extent new technologies or ideas propagate. The hypothesis was born out of a desire to understand how new technologies are pushed and promoted within a social structure. According to Rogers (2010), innovation is not immediately adopted by a social system as a whole; rather, it is a procedure in which certain banks or individuals are more suited to adopting innovation than others.

The DoI processes are suited for blockchain adoption, and they include learning about blockchain through the DoI, making a choice to accept if the technology meets their needs, and either continuing to use it after the evaluation time or rejecting it.

Rogers' Diffusion of Innovation (DoI) theory was one of the most widely used technology adoption ideas (Brancheau & Wetherbe 1990). The theory was initially suggested in 1962, and it was later revised in 1983. "Diffusion is the process by which an invention gets disseminated through a channel over time in a social system," according to Rogers (2010), a concept or object that is seen as a novel by the individual is referred to as an innovation. The four key aspects in the diffusion process, according to the Diffusion of Innovations, are (1) the invention, (2) its transmission from one individual to another, (3) the social structure, and (4) over time (Rogers & Shoemaker, 1971). The interaction between one individual expressing an original idea to another is at the heart of the diffusion process. It may be claimed that it is applicable to the business world based on these definitions.

Rogers (2010) proposed that diffusion happens through a five-step decision-making process, which includes: (1) becoming aware of the idea or technology; (2) being

convinced that the idea will be helpful; (3) deciding whether to accept or reject it; (4) implementing; and (5) confirming whether it is satisfactory or not. According to the idea, there are five main variables that affect how quickly innovations spread: the innovation itself, the adopters, the communication channels, the passage of time, and the social system or the social environment in which adoption takes place. As a result, if the new invention is beneficial, simple to use, and inexpensive, society will embrace it and begin disseminating information about the innovation.

As experienced by the individual, Rogers has five qualities of innovation which are as follow:

1. Relative Advantage: "the degree to which a new idea is seen as being better than the one it replaces.
2. Compatibility: "the level of compatibility an innovation is deemed to have with the values, experiences, and requirements of future users.
3. Difficulty of understanding and application: "the degree to which an innovation is perceived as challenging to understand and use.
4. Trialability: "the degree to which a concept may be evaluated on a small scale."
5. Observability: "the degree to which an innovation's effects are visible to other people.

The five groups are innovators, early adopters, early majority, late majority, and laggards. That the theory divides innovation adopters into. The innovators are the innovators' founders; they are willing to take the risk of introducing new technologies. The early adopters are the first to accept the innovation; the group generally consists of a few firms that jump on board with the new trend rapidly. Before embracing new technology, the early majority is concerned with seeing proof of its use. The late majority must be persuaded that the innovation is beneficial since they are resistant to change and will not adopt it until the majority has given it a try. The last to adopt innovations are the laggards; they are averse to change and the most complex group to persuade to participate in the adoption process. According to academics, those who accept innovation at first have different characteristics from those who do so later. In the socio-technical context of today, this concept is still applicable (Park, 2009).

Technology adoption is important in technology evaluation since it provides academically-based cost-saving insight on the relevance of technology investment in every company (Chau, 1996). It enables academics to look at factors that could affect the acceptance and successful application of technology in a particular environment.

As a result, this study's theoretical framework was built on a popular innovation theory, the DoI theory (Rogers 2010). It gave a thorough examination of the technology behind a specific organizational breakthrough. The hypothesis served as a foundation for determining whether or not to embrace blockchain technology within the firm.

Many technical innovation adoptions have been based on the DoI idea. DoI distinguishes between the different processes by which individuals or banks accept original innovations in the middle of dissemination, according to advocates of the theory, and the processes are still very relevant to the current moment. Furthermore, the DoI methods are ideal for blockchain implementation. These include (1) learning about blockchain through the DoI, (2) deciding to adopt, (3) continuing to use the technology if it fulfills their needs, and (4) rejecting it at the conclusion of the assessment period.

Catalini & Gans (2020) provided a detailed conceptual framework to evaluate the adoption of blockchain. The framework encompasses the market power which would be developed due to competition and barriers created and the costs associated with blockchain complexity.

Following the aim and objectives of this research and to address its problem, DOI theory has been employed to develop the theoretical framework as it allows the discovery of the features that may affect the successful deployment of technology into a targeted environment.

This research aims to exploratory test the influence of blockchain on the financial functions of the Egyptian banking sector, and then to apply both strength, weaknesses, opportunities, and threats (SWOT) and benchmark methods to evaluate a current blockchain applied bank.

3. Literature review

The literature review provides historical background for the main competencies and skills required for future banks, followed by the findings of previous researchers and academicians. This section is divided into three main categories; the first section provides an overview of literature studies that showed the importance of progress in technology to face future challenges. The second depicts the literature that surveyed blockchain studies, followed by the third part discussing literature on the blockchain application.

First of all, an overview of literature studies that showed the importance of progress in technology to face future challenges. Coyne & McMickle (2017) concluded that Blockchain has a direct impact on solving Byzantine generals' problem and recommended more work on some parts of blockchain models for accounting purposes and financial reporting. Hamori et al. (2018) analyzed the default payment data by comparing the random forest prediction and classification abilities with neural network methods. Hamori et al. suggested that using blockchain models benefits future bank functions.

Hans et al. (2019) investigated quantum calculations to examine the processing speed and the memory from standard computer to supercomputer using a simulator called "Julich universal quantum computer simulator," which acts as a sequence of matrix-vector processes involving scattered matrices. In the same line, Gill et al. (2019) proposed a conceptual model for cloud futurology to explore the application of emerging paradigms by studying blockchain, quantum counting, and artificial intelligence and how they would affect future cloud computing systems. Furthermore, Gill et al.'s study identified many other technologies and invited international experts to determine cloud computing's current and future directions.

The second section discusses the literature that surveyed blockchain studies. Yli-Huumo et al.(2016) studied 41 research papers on blockchain technology from the technical perspective. Yli-Huumo et al. declared that 80 percent of the research focused on bitcoin, and they concluded that most studies' scope was on the benefits of blockchain while neglecting its drawbacks and challenges. Zhao, Fan, & Yan (2016) explored blockchain technology and concluded that bitcoin would open new ways for research development and innovation.

Cai (2018) reviewed and identified gaps in 402 papers published between 2010 and 2018 in two FinTech applications; crowdfunding and Blockchain. Cai concluded that crowdfunding and Blockchain disrupt traditional intermediaries and create new ones.

Sangwan et al. (2020) surveyed 130 academic papers that discussed FinTech and provided a summary of their gaps and findings. Sangwan et al. studied the three aspects of FinTech; technology, regulations, and the financial industry. They concluded that FinTech is in its initial phase and requires continuous improvement and development in three dimensions; market players, consumers, and regulation.

The third part illustrates a literature review regarding blockchain applications. Studies that discussed the impact of FinTech on banking and financial sectors and identified its importance are Jagtiani & Lemieux (2019a, 2018b) and Navaretti et al. (2018) who added that while FinTech improves banks' efficiency, it increases competition as well. Gozman & Willcocks (2019) and Jakšić & Marinc (2019) agreed that FinTech is a competitive advantage that would confuse traditional banks. Rabbani et al. (2020) reviewed the academic papers in the Islamic financial technology area and classified them into three categories; Islamic FinTech, Islamic Financial technology opportunities and challenges, Cryptocurrency/blockchain sharia compliance, and law/regulation.

Elliot et al. (2021) Stated that blockchain technology is not currently perceived to provide benefits that would outweigh the costs of introducing it into West Sweden's export firms. Nevertheless, the findings suggest that such technology, though currently too immature to meet today's industrial requirements, could experience more widespread use if certain key factors (i.e. lower cost, traceability, improved security or trustworthiness and new blockchain-enabled business models) are prioritized.

Al Kemyani et al (2022) clarified that blockchain technology enables quicker, cheaper, and more inventive transactions. By allowing people and organizations to trade directly and utilize the same record of transactions that is amended by the majority and made unchangeable by encryption, applying blockchain technology can help banks cut the settlement time. The existing system of money transfers and payments is run by third parties who charge large transfer fees, particularly for international payments. However, implementing a decentralized payment network

will result in lower transaction costs and lower transfer fees. Because transaction fees are reduced, customers will spend less money overall and have more chances to save.

Therefore, a decentralized system's payment services rely on blockchain technology, and international transactions are quicker and cheaper. Additionally, compared to the present system, the blockchain technology system offers a greater level of security. owing to storing all data in a single, centralized database set, which can prevent attacks that could disrupt the data set. Additionally, several nodes have to copy the sent record. The transaction should be authorized using this. If any of the nodes disagree, the trade cannot happen. Therefore, it will be taken out.

But there are several restrictions when employing blockchain in the financial industry. Due to the high cost of using blockchain technology in the banking industry, it is necessary to increase staff technology literacy and hold workshops to effectively impart technological education. Additionally, it is anticipated that government support will keep pace with corporate industry technical improvements. This technology is limited in its ability to fix mistakes, and there is also a danger of hacking and no applicable legal restrictions. We think that blockchain technology will be able to overcome many of the difficulties it is now facing as more people get aware with it and use it more often.

Sharma (2020) aimed to study the impact of blockchain and cryptocurrency on the banking sector using the blockchain Fit Assessment Framework. Sharma analyzed the operation and functions of the technology advancement and its impact on the banking industry. Sharma concluded that technology has a great impact on the banking industry and banks are willing to exploit the fourth technological revolution. Sharma explored the banking industry's current problems in India, such as cost of operation, transparency, and fraud.

On the other side, Mosteanu & Faccia (2020) is an exploratory research project that aims to identify and manage new approaches to financial methods to achieve more sustainable business and economic development. Mosteanu & Faccia clarified the benefits of artificial intelligence and digital systems using XBRL and blockchain in financial sectors and recommended the management and supervision of these new

tools. Both Sharma and Mosteanu & Faccia concluded that the move toward blockchain and cryptocurrency would reduce the cost and time delay.

In the Egyptian banking Gamal & Aref (2022) found that were awareness of the potential advantages of using BCT, but it is clear that some are already on track while others are still in the planning stages. Not only must workers be involved in BCT implementation, but awareness of the primary danger sources is also necessary. Lack of information, a lack of confidence in the system, and system complexity are all risk factors that have an adverse impact on adoption. To prosper in the new system, it is crucial to improve society's awareness and comprehension of new technology as well as reassure people about security dangers.

The proper training tactics that can develop employees' talents are one of the aspects of such setting that must be addressed. The importance of training was made evident by the respondents' opinions, who believed that if workers were adequately taught, it would be simple to use technology. The research analysis also highlighted how BCT adoption may improve the key three elements that might affect a bank's performance and sustainability. The most significant aspect affecting consumers' experiences in the banking industry is customer convenience, which will be improved by the adoption of BCT by removing redundant data collecting.

4. Design of the Survey

The research question, "To what extent has blockchain been used in the banking industry, and how is the technology understood?" was inspired by the dearth of information currently available on the usage of blockchain by industrial banks, and if they do, why and how. The survey linked between literature and the fit-analysis model through setting questions that displayed the research questions. By conducting a survey that covered the categories described above in relation to organizational adoption of blockchain, the researchers attempted to answer that issue.

Some countries have applied blockchain technology in banking systems, such as India, which has developed the fit assessment framework. The developed framework is used to assess the fitting and value of blockchain in selected units in Indian banks that apply it to evaluate the right use of blockchain according to certain criteria; transparency, manual processing, intermediary, information

storage, trust, time sensitivity, and documentation (Shah & Jani, 2018; and Sharma, 2020).

The fit assessment works on affirming a group of questions to identify the impact of blockchain on each criterion and to clarify the weak points that blockchain can help in and how this help would affect its improvement. Shah and Jani (2018) presented specific cases where blockchain is believed to add value for Indian banks and financial institutions, which are consortium and risk-diversifying banking, electronic payment, and KYC, which is considered repetitive and consumes both time and cost. Sharma (2020) added digital currency and supply chain financing.

The fit assessment model is modified and linked to the survey questions to reflect the nature of the research and to find the potential opportunities and challenges that would face Blockchain technology in Egypt. The dearth of research prompted us to use an exploratory survey methodology that prioritizes descriptive outcomes (Hlström and Westbrook, 1999).

In the current research, the researchers conducted an online survey in collaboration with Google forms in September 2022 to 245 employees in the Egyptian banking industry. Because of the time and effort consideration, the researchers collected 100 responses with a response rate of 39%. The response rate was not high.

Due to the survey's exploratory nature and considering the time constraints of the targeted respondents, the survey was kept brief and was divided into two parts written in English and Arabic.

The survey started with directions that illustrate the competence of the survey and the fact that it is a voluntary activity. The first part consisted of demographic questions about the respondent, education degree, undergraduate degree specialist, current job position, job level, full-time work experience area, years of work experience, gender, and the bank size i.e. number of employees. Next, the survey offered a written outline of the blockchain technology enhanced by an explanatory figure as well as an illustrative video.

The second part consisted of questions addressing the respondent's personal perception of blockchain. The response options were designed to get answers about the bank's intention to adopt blockchain, the technology the bank plan to invest in the next five year, the technology the bank intent to invest in the next five year, the bank plan to adopt the blockchain, the department/unit responsible for blockchain

adoption, the bank budget for blockchain, feeling that blockchain will make a difference in the bank, blockchain challenges that would affect the bank, reasons behind the bank's interest in blockchain, the most appropriate blockchain platform for the bank, the phase of blockchain penetration testing, if COVID-19 enhances the adoption of blockchain and other Fintech technology and finally the area of banking systems that would be affected the most by the pandemic.

The research hypotheses and questions developed based on the literature are as follows in Table 1:

Table 1: Research hypotheses and questions:

<i>Research hypotheses</i>	<i>Research questions</i>
H1: Egyptian Banking Industry intends to adopt Blockchain	Is the Egyptian Banking Industry ready to adopt Blockchain?
H2: Blockchain has high cost and long latency in Egyptian Banking Industry	<ul style="list-style-type: none"> • Does Blockchain requires high fees for intermediaries? • Is there any Latency due to intermediary processing?
H3: Blockchain increases Transparency in Egyptian Banking Industry	<ul style="list-style-type: none"> • Are multiple participants involved? • Does an increase in transparency into the transaction help the participants?
H4: Blockchain has information storage challenge in Egyptian Banking Industry	<ul style="list-style-type: none"> • Is the same information required to be stored in multiple locations? • Is data consistency an issue?
H5: Blockchain has high reconciliation cost and time in Egyptian Banking Industry	<ul style="list-style-type: none"> • Is the system fully automated or include manual processes? • Is the Reconciliation cost high? • Is a large number of documents or

	reports required?
H6: COVID-19 enhanced the adoption of Blockchain due to time sensitivity in Egyptian Banking Industry	<ul style="list-style-type: none"> • Will the transactions benefit from being real-time or synchronous?
H7: Blockchain increases trust among participants in cost of time consumption process in Egyptian Banking Industry	<ul style="list-style-type: none"> • Does lack of trust among participants allow for multiple validation? • Is there a risk of fraudulent transactions?

5. Results

Revealing a general openness to and curiosity about blockchain, the survey's results highlighted that respondents believed blockchain would impact their industry. At the same time, they admitted that their general understanding of blockchain was relatively low; few companies had any projects regarding, and the knowledge of how blockchain could be used in their banks was insufficient, as shown in Table 1.

Regarding the intention to adopt blockchain, although 27% of respondents had adapted or implemented "blockchain," Most banks in the planning phase of blockchain adoption 41%. Moreover, 16% of respondents claimed to explore blockchain technology and started to work. But, 16% of respondents claimed to have no initiatives or were not interested.

Concerning the technology the bank plans to invest in in the next five years, most respondents ranked Artificial intelligence at 57%, followed by blockchain at 42%, and lastly, data mining technology at 1%.

Inquiring from the respondents about the bank's plan to adopt blockchain, 28% of the respondents confirmed that a dedicated team had been assigned, but blockchain is not yet adopted. 23% of the respondents already have a team working on blockchain customization. Furthermore, 26 % of the respondents confirmed that a dedicated team would be established within the last 12 months considering outsourcing. 23% of the respondents do not consider the issue at all.

The respondents inquired about the department/unit leading the effort for blockchain adoption. The majority of the banks, 62%, reported that IT: Information Technology is the department conducting the adoption process of blockchain. 29% of the banks stated that the R&D: Research and development department is the department responsible for blockchain adoption. Only 9% of the banks said that the Info security department is responsible for blockchain adoption.

The bank budget for blockchain 48% of the respondents replied that their banks put a budget for blockchain adoption. At the same time, 46% of the respondents retorted that they do not know if their banks put a budget for blockchain adoption or not, and only 6% replied that no budget is assigned to blockchain adoption in their banks.

62% of the respondents feel blockchain will make a difference in the bank within 3-5 years. Meanwhile, 19% of the respondents think blockchain will make a difference in the bank this year. A similar percentage, 19% of the respondents, feel that blockchain will show a difference in the bank will take a long time, not at least ten years.

From respondents' perspective, blockchain challenges affecting the bank cost 36%, complexity 30%, employee resistance 19%, and security 15%, respectively.

From the respondents' perspective, the reasons behind your bank's interest in blockchain are easiness of monitoring transactions 44%, saving time 35%, and security 21%.

Blockchain has several platforms, and each bank has to choose one; the respondents stated that the most appropriate blockchain platform is the Private and decentralized: efficient, customized, secured, and controlled by a highly trusted bank, partially decentralized, and permissions are needed to read and write data 57%. Meanwhile, 29% choose the Public and centralized blockchain platform: inefficient for all nodes, secured, but anyone anywhere can read and write on the network. Only 14% prefer Consortium/hybrid blockchain platform: efficient and controlled by a few predetermined nodes, partially decentralized, a hybrid between private and public blockchain, and permissions are needed to verify, read and write data.

Blockchain penetration testing is a security-focused assessment process performed by security specialists or ethical hackers to test the security level of the blockchain-

driven solution or blockchain application. About the phase of blockchain penetration testing, 50% of respondents stated that they are in Phase 1: information gathering and threat modeling: this phase is about understanding and analyzing the business and functional requirements, finding threats, and checking compliance readiness and testing environment. 25% stated that they are in Phase 2: Testing and discovery: this phase is about performing blockchain tests to assess against best practices and standards. 6% stated that they are in Phase 3: exploitation: this phase aims to eliminate any security weaknesses and loopholes discovered in phase 2. Lastly, 19% believed that they were not applicable at all.

An agreement was high with the statements that COVID-19 enhances the adoption of blockchain and other Fintech technology, as 62% of respondents replied with "Yes." 25% were unsure if COVID-19 enhances the adoption of blockchain and other Fintech technology. 14% of the respondents strongly disagreed that COVID-19 enhances the adoption of blockchain and other Fintech technology.

Remarkably, the area of banking systems that would be affected the most by the pandemic is Digital channels for customer services 41%, embracing new technologies. Digitalization of banking transactions and delivery methods by 28% increases security and customer trust by reducing cyber risks by 22% and by 9% increase payment infrastructure.

Table 2: The Analysis of the Survey Results

1. The bank's intention to adopt Blockchain					
Adopting/ implemented	Plan to adopt	no initiatives/ not interested	Exploring blockchain technology and started to work in	Mean	SD
27	41	16	16	2.21	1.017
2.The technology the bank plan to invest in the next five year					
Blockchain	Artificial intelligence	data mining			
42	57	1		1.5900	0.514 34
3. The bank plan to adopt the Blockchain					
A dedicated team has been assigned, but	A team is already	A dedicated team will be	Not considered		

Blockchain is not yet adopted	existing	established within the last 12-month considering outsourcing.			
28	23	26	23	2.44	1.131
4. The department/unit is leading the effort for blockchain adoption					
IT: Information Technology	Info Security	R&D: Research and development			
62	9	29		1.6	0.928
5. Blockchain requires high intermediary fees (Transaction cost)					
Yes	No	I don't know			
48	6	46		1.97	0.9717
6. Feeling that Blockchain will make a difference in the bank					
This year	within 3-5 years	not at least 10 years			
19	62	19		2.00	0.619
7. Blockchain challenges that would affect the bank					
Employee resistance	Cost	Complexity	Security		
19	36	30	15	2.41	0.96
8. The reasons behind your bank's interest in Blockchain					
Security	Easiness to monitor transactions	Save time			
21	44	35		2.14	0.73
9. The most appropriate Blockchain platform of data storage for your bank					
Public and centralized: inefficient for all nodes, secured, but anyone anywhere can read and write on the network.	Private and decentralized: efficient, customized, secured, and controlled by a highly trusted bank; partially	Consortium/hybrid: efficient and controlled by a few predetermined nodes, partially decentralized, a hybrid between private and			

	decentralized, permissions are needed to read and write data.	public blockchain, and permissions are needed to verify, read and write data.			
29	57	14		1.85	0.64
10. The phase of blockchain penetration testing					
Phase 1: information gathering and threat modeling: this phase is about understanding and analyzing the business and functional requirements, finding threats, and checking compliance readiness and testing environment.	Phase 2: testing and discovery: this phase is about performing blockchain tests to assess against best practices and standards.	Phase 3: exploitation: this phase aims to eliminate any security weaknesses and loopholes discovered in phase 2.	Not applicable		
50	25	6	19	1.9	1.15
11. COVID-19 enhances the adoption of Blockchain and other Fintech technology					
Yes	No	May be			
61	14	25		1.63	0.86
12. The area of banking systems that would be affected the most by the pandemic					
Embracing new technologies – Digitalization of banking transactions and delivery methods,	Digital channels for customer services	increase security and customer trust through reducing cyber risks	increase payment infrastructure		
28	41	22	9	2.12	0.924

6. Discussion

Blockchain systems have a plethora of risks and challenges that may face the users and may have a negative impact on using the system. blockchain systems are evaluated and assessed through different models.

According to the fit assessment model, the research survey has filled the requirements needed to apply blockchain in Egyptian banks. The survey started by asking whether the bank is applying or intending to apply blockchain or not; most participants declared that the bank is planning to apply. This response indicated that the research study is to be exploratory to what blockchain technology adoption will be in the next 3-5 years in Egyptian banks. The fit assessment model is modified to reflect the nature of the study and to find the potential opportunities and challenges that would face blockchain technology in Egypt. The link between the fit assessment model and survey responses is illustrated in the next table.

The first part of the questions is concerned with high intermediary fees; which were answered in Q 5 and Q7 in the survey. The next section was concerned with transparency and trust issues illustrated by Q8 that showed the reasons behind bank's interest in blockchain were easiness to monitor transactions and saving time. The third section is about information storage that most respondents required to have customized blockchain controlled by a highly trusted organization to save storage, as illustrated in Q9. The fourth section are about manual processing and documentation, they are illustrated in Q12; respondents declared that digital channels for customer services are required to be automated and digitalized, and they stated that the IT department should be responsible for blockchain adoption. The employee resistance are discussed in Q5 and Q7.

The fit assessment analysis based on the survey results and discussion is shown in the following Table 3.

Table 3: The Fit Assessment Analysis for Blockchain-Based on the Survey Results

<i>Factor</i>	<i>Assessment Framework</i>	<i>Impact of Blockchain Fit</i>	Results from survey	
			Current main Points	How Can Blockchain help?
Intermediary	• Does Blockchain requires high fees for	Blockchain is supposed to reduce the latency and cost	Most respondents expect that Blockchain won't reduce high	Blockchain uses automated, integrated technology for

	<p>intermediaries?</p> <ul style="list-style-type: none"> • Is there any Latency due to intermediary processing? 	<p>due to ledger distribution technology facilitating and decreasing the intermediation processes.</p>	<p>intermediary's fees (employee resistant to change). Q5 Most respondents agreed that blockchain challenges that would affect the bank are cost, followed by complexity. Q7</p>	<p>information analysis and due diligence for loan underwriting.</p>
<p>Transparency & Trust</p>	<ul style="list-style-type: none"> • Does an increase in transparency into the transaction help the participants? • Does lack of trust among participants allow for multiple validation? • Is there a risk of fraudulent transactions? 	<p>The hash/pointers of the records written on the Blockchain are immutable and irreversible, not allowing modifications and eliminating the risk of fraud. Blockchain reduces manual processing through smart contracts and digitalization to increase validations and reconciliation and to reduce fraudulent transactions.</p>	<p>Time-consuming process: Selection of members based on financial and industry expertise, involvement of multiple participants and the process of evaluation of borrower's financial background are time consuming processes.</p> <p>Most respondents declared that reasons behind their bank's interest in Blockchain is easiness to monitor transactions which lead to transparency and trust. Q 8 Most respondents agreed that</p>	<p>Centralized blockchain-based KYC Faster syndicate formation: Automated selection criteria for syndicate formation in programmable smart contracts.</p>

			Blockchain will make a difference in the bank within 3-5 years. Q6	
Information Storage	<ul style="list-style-type: none"> • Is the same information required to be stored in multiple locations? • Is data consistency an issue? 	Blockchain technology allows data consistency for multiple participants.	The most appropriate blockchain platform for most respondents' banks is private and decentralized: efficient, customized, secured, and controlled by a highly trusted organization; partially decentralized, permissions are needed to read and write data. Q9	
Documentation and Manual Processing	<ul style="list-style-type: none"> • Is the system fully automated or includes manual processes? • Is the Reconciliation cost high? • large number of documents or reports required? 	Blockchain reduces manual processing and uses automated audit trail transactions and smart contracts for reconciliations and data validations	The switch from manual systems to automated ones will take a long time, as well as increase the cost of operations. Documents duplications and lack of information integration would result in increasing fraud risk and effort supplication as well. Respondents agreed on the area of banking systems that would be affected the	Documents Digitization: Blockchain automates checks and validations, as well as digitalizes agreements, contracts, documents, and agreements. Blockchain reduces document duplications. Automated

			most by the pandemic is Digital channels for customer services Q12 Respondents agreed that The department/unit leading the effort for blockchain adoption is IT. Q4	documentation and Intra-bank applications Real time-tracking of transaction and Intra-bank applications
Time Sensitivity	• Will the transactions benefit from being real-time or synchronous?	Blockchain uses near real-time recorded transactions to enhance customer experience and reduce risk.	Delayed settlement cycles: for payments, lock up capital and increase default risk. Most respondents agreed that COVID-19 enhances the adoption of Blockchain and other Fintech technology. Q11	Real-time settlement of transaction and Settlement periods reduction: Blockchain uses smart contracts to facilitate near real-time loan funding and payment settlements.

Accordingly, the researchers have developed strengths (advantages), weaknesses (disadvantages), opportunities, and risks (challenges) of adopting blockchain systems (SWOT) analysis that evaluates and clarifies the different aspects of blockchain according to the literature and the results from the survey. The model developed resembles Osmani, et al. (2020)'s cost, benefits, risks, and opportunities framework. The SWOT analysis is illustrated in the following Table 4.

Table 4: SWOT Analysis for Blockchain-Based on the Survey Results

Advantages/ Strengths (S)	Literature review	Disadvantages/ Weaknesses (W)	Literature review
<p>1. Transaction costs reduction: direct access decreases the bank reconciliation costs and losses due to fraud.</p> <p>2. Efficiency: reduces the time of decision making and human intervention, reduces the record keeping duplications, reduces reconciliations, and minimizes errors & frauds.</p> <p>3. Eliminates intermediaries/Trust: is based on cryptography which reduces the overheads costs due to direct parties' transactions, and replaces third-party intermediaries as the keeper of trust.</p> <p>4. Transparency: it provides details about the original message in the area of payment.</p>	<p>Gupta and Gupta (2018); Al-Subaie (2019)</p>	<p>1. High Storage costs: due to large data required.</p> <p>2. Technical and Scalability: it requires a large database and high processing speed due to large data.</p> <p>3. Energy Consumption and cost: It requires large computing power.</p>	<p>Gupta and Gupta (2018); Baudier, et al. (2020); Osmani, et al. (2020)</p>
Opportunities (O)	Literature review	Challenges and Risks/ Threats (T)	Literature review
<p>1. Competitive advantage and new services formation.</p> <p>2. Reduce risk: due to transparency and intermediaries eliminations.</p> <p>3. Decentralization: it is not controlled by one bank.</p>	<p>Kshetri and Voas (2018) ; Swan, (2017), Rogers (2010)</p>	<p>1. Interoperability: it lacks international standards for comparability.</p> <p>2. Privacy: data on Blockchain is shared publicly and anyone can</p>	<p>Gupta and Gupta (2018); Baudier, et al. (2020); Osmani, et al. (2020)</p>

<p>4. Enhanced Security: it is difficult for hacking. 5. Vulnerability: to ensure the right transaction reaches the correct persons. 6. Lending and interest operations: it eliminates intermediaries that will force banks to reduce the interest rate on loans and provide better offers.</p>		<p>see it. 3. Encryption and Integrity of data: it can be broken through loopholes due to manipulation or misuse of data especially if the key is public. 4. Security: complex cryptography decreases hack risk, but it requires multi-level security. 5. Legal Framework: it lacks national and international regulations, and there is no government support to add trust to the system. 6. Lack of clarity: regarding smart contracts and business gains. 7. Threat to traditional business models.</p>	
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The researchers have concluded that H1, H2, H4, H5, and H6 are accepted, while H3 and H7 are due to incomplete adoption of Blockchain in Egyptian Banking Industry. The link between the research hypotheses, research questions, and results is illustrated in table 5 as follows:

Table 5: Summary of hypotheses, results, and their link to hypotheses

<i>Research hypotheses</i>	<i>Factor</i>	<i>Research questions</i>	<i>Accept/reject the hypothesis</i>	<i>SWOT analysis conclusion</i>
H1: Egyptian Banking Industry is intending to adopt Blockchain	Adoption	Is the Egyptian Banking Industry ready to adopt Blockchain?	Accept Q1	O1

H2: Blockchain has high cost and long latency in Egyptian Banking Industry	Intermediary	<ul style="list-style-type: none"> • High fees for intermediaries? • Is there any Latency due to intermediary processing? 	Accept Q5,Q7, Q3	W4 S2
H3: Blockchain increases Transparency in Egyptian Banking Industry	Transparency	<ul style="list-style-type: none"> • Are multiple participants involved? • Does an increase in transparency into the transaction help the participants? 	N/A Reject due to incomplete adoption of Blockchain in the Egyptian Banking Industry Q3	S3 S4
H4: Blockchain has information storage challenge in the Egyptian Banking Industry	Information Storage	<ul style="list-style-type: none"> • Is the same information required to be stored in multiple locations? • Is data consistency an issue? 	Yes Accepted But it can be solved by using customized platforms Q9	W1 W2 O3
H5: Blockchain has high reconciliation cost and time in the Egyptian Banking Industry	Documentation and Manual Processing	<ul style="list-style-type: none"> • Is the system fully automated or includes manual processes? • Is the Reconciliation cost high? • Is a large number of documents or reports required? 	Accept Q4,12	T3 O4 T2 O2 W3

<p>H6: COVID-19 enhanced the adoption of Blockchain due to time sensitivity in the Egyptian Banking Industry</p>	<p>Time Sensitivity</p>	<ul style="list-style-type: none"> • Will the transactions benefit from being real-time or synchronous? 	<p>Accept Q11</p>	
<p>H7: Blockchain increases trust among participants in cost of time-consuming process in the Egyptian Banking Industry</p>	<p>Trust</p>	<p>Does lack of trust among participants allow for multiple validation?</p> <ul style="list-style-type: none"> • Is there a risk of fraudulent transactions? 	<p>N/A Reject due to incomplete adoption of Blockchain in the Egyptian Banking Industry, although most respondents agreed that Blockchain would make a difference within the next 3-5 years. Q8, Q6</p>	<p>W1</p>

The researchers further evaluated the performance the largest bank in Egypt “The national bank of Egypt (NBE)” who started blockchain in February 2021. NBE is using the RippleNet blockchain for cross border payments with the United Arab Emirates currency exchange firm “[Lulu International Exchange](#)”. The researchers used SWOT analysis and Benchmark strategic managerial accounting tools to evaluate the performance of the NBE in accordance with the performance of the Commercial international Bank Egypt (CIB) which is one of the largest banks in the world and it operates in Egypt.

The researchers observed each item included in the SWOT according to the

respondents of the survey and counted the presence of each item, then weighted each one according to the absence or presence of it.

Table 6: Weight for each SWOT item

SWOT item	Weight	SWOT item	Weight
s1	0.125	o1	0.2
s2	0.125	o2	0.1
s3	0.125	o3	0.2
s4	0.125	o4	0.1
w1	0.125	T1	0.2
w2	0.125	T2	0.1
w3	0.125	T3	0.1
w4	0.125		
Total	1	Total	1

The researchers used content analysis of the annual reports, financial statements, environmental, social and governmental report (ESG), and bank website to compare between NBE and CIB in accordance to the SWOT analysis items (as previously mentioned in table 4). The analysis is illustrated in the following table 7:

Table 7: Benchmark analysis for NBE against CIB

AWOT analysis	Weight	NBE rank	NBE Total	CIB rank	CIB Total
Strengths			Strengths		Strengths
1. Transaction costs reduction: direct access decreases the bank reconciliation costs and losses due to fraud.	0.125	4	0.5	3	0.375
2. Efficiency: reduces the time of decision making and human intervention, reduces the record keeping	0.125	4	0.5	3	0.375

duplications, reduces reconciliations, and minimizes errors & frauds.					
3. Eliminates intermediaries/Trust: is based on cryptography which reduces the overheads costs due to direct parties transactions, and replaces third-party intermediaries as the keeper of trust.	0.125	3	0.375	3	0.375
4. Transparency: it provides details about the original message in the area of payment.	0.125	3	0.375	3	0.375
Weaknesses			Weaknesses		Weaknesses
1. High Storage costs: due to large data required.	0.125	0	0	0	0
2. Technical and Scalability: it requires a large database and high processing speed due to large data.	0.125	2	0.25	1	0.125
3. Energy Consumption and cost: It requires large computing power.	0.125	1	0.125	0	0
4. High intermediary fees	0.125	1	0.125	0	0
Total 1	1		2.25		1.625
Opportunities			Opportunities		Opportunities
1. Competitive advantage and new services formation.	0.2	4	0.8	4	0.8
2. Reduce risk: due to transparency and intermediaries eliminations.	0.1	3	0.3	4	0.4
3. Decentralization: it is not controlled by one organization.	0.1	3	0.3	4	0.4
4. Enhanced Security: it is difficult for hacking.	0.2	4	0.8	4	0.8

Threats			Threats		Threats
1. Interoperability: it lacks international standards for comparability.	0.2	2	0.4	2	0.4
2. Privacy: data on Blockchain is shared publicly and anyone can see it.	0.1	1	0.1	2	0.2
3. Encryption and Integrity of data: it can be broken through loopholes due to manipulation	0.1	2	0.2	2	0.2
Total 1	1		2.9		3.2

The results show that from strength and weaknesses (inner) prospective; NBE is better than CIB; this would be a result of NBE good internal control and highly proactive to blockchain technology adoption. While from the external (opportunities and threats) CIB is better than NBE; this is due to that NBE is in his first year of blockchain rather than CIB which is a pioneer in blockchain technology. Both banks face same threat i.e.; Interoperability due to the lack of international standards for comparability.

7. Conclusion and Recommendations

The insightful conclusions of this research are not without drawbacks, such as a low response rate that precludes more complex statistical studies. Additionally, respondents' responses were predicated on their individualized perceptions about blockchain, which in the majority of cases lacked any relevant practical knowledge. Future qualitative research and in-depth interviews with managers who have successfully adopted Blockchain in their banks and have relevant expertise may offer deeper insights into how top-level management perceives blockchain.

It is recommended for banks to have a better grasp of how blockchain technology might disrupt the fintech industry given its increased use and quick development, as well as to work to raise public awareness. This can be done by developing coordinated policy approaches for blockchain technology, encouraging investment in blockchain research and development, working to increase human capacity for blockchain technology, supporting an enabling policy environment for blockchain technology, and cooperating internationally on blockchain technology. It is recommended as well for both the government

and the CBE to provide both awareness and support for blockchain technology to financial sectors. Training and financial support is required to move the Egyptian financial sector to new digitalization era including blockchain and Fintech.

Future researches are required to provide more in-depth study for the digitalization requirement for the Egyptian economy and its impact on the development and enhancement required to meet the 2030 vision. Further researches may provide international comparison between different nations to investigate the impact of digitalization and blockchain on both financial and non-financial sectors. It is recommended to repeat this research after full adaption for blockchain in the Egyptian economy, besides it is advisable to investigate the impact of it in non-financial sectors as well.

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