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## Blockchain Technology for Reshaping Stock Exchanges: A qualitative exploratory study in Palestine

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### Recommended Citation

Aburidi, Asia (2022) "Blockchain Technology for Reshaping Stock Exchanges: A qualitative exploratory study in Palestine," *Arab Economic and Business Journal*: Vol. 14 : Iss. 1 , Article 6.

Available at: <https://doi.org/10.38039/2214-4625.1008>

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## RESEARCH ARTICLE

# Blockchain Technology for Reshaping Stock Exchanges: A Qualitative Exploratory Study in Palestine

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### Abstract

**Purpose:** This research aims to explore how to reshape stock exchanges by using blockchain technology with an emphasis on the case of the Palestine Exchange. **Design/methodology/approach:** This research gathered primary data from semi-structured and open-ended interviews. Online interviews were conducted to get information from professionals and academics interested in blockchain. The sample for this research was determined using convenience sampling and a snowball sampling approach. The data was analyzed using the deductive content analysis method. **Findings:** The research revealed that implementing blockchain is appropriate for third-world countries because it does not necessitate the construction of buildings or infrastructure. Additionally, the results showed that by implementing this technology, the Palestine Exchange will be able to speed up its liquidity cycle while also lowering costs, boosting transparency, allowing for the trading of new products, and attracting new investors. The legal and technological concerns, however, are not seen as impediments to the implementation of blockchain in the Palestine Exchange. **Practical implications:** The findings of this research will contribute to the growth of the Palestine Exchange. **Originality/value:** There has not been much focus in studies on Palestine in this context. This research aims to close the gap by investigating how blockchain might be used to reshape the Palestine Exchange.

**Keywords:** Stock exchange, Blockchain, Financial markets, Palestine Exchange

## 1. Introduction

People have relied on financial services to meet their requirements for thousands of years, from transferring monies to purchasing assets to exchanging bonds and stocks. In order to create confidence and verify identity in a financial transaction, intermediaries have emerged (Estelami, 2012). The financial services operations revolutionized the way businesses operate, such as deposit ownership organizations like Carta<sup>1</sup>, which is a safe digital form of ownership for security deposits invested in secured assets, and Abu- Ghazaleh Intellectual Property “AGIP” (Abu-Ghazaleh, 2019). In addition, the globe is moving toward the adoption of digital technologies in a variety of industries,

particularly in the provision of financial services. Following the Covid-19 pandemic, there was a spike in interest in the use of technology to perform financial services.

In the evolution of financial services, technological innovation is critical. It has a significant impact on the core of major financial institutions, particularly in financial markets. As a result, stock exchanges all over the world, including the US stock market, Nasdaq, and leading Swedish bank SEB are now leveraging technology to remodel existing procedures and come up with efficient available solutions (Andreev et al., 2018). Surprisingly, blockchain technology is ahead of these advancements and has significantly improved many financial sector activities. As a result, Nasdaq has partnered up with

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Received 26 October 2021; revised 13 November 2021; accepted 12 December 2021.

Available online 7 April 2022.

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<sup>1</sup> Carta is a trustworthy digital form of ownership for security deposits invested in secured assets. See <https://cartacoin.io/>.

<https://doi.org/10.38039/2214-4625.1008>

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leading Swedish bank SEB, to develop a blockchain-based mutual-fund trading platform that aims to speed up and simplify several operations (Manning, 2018).

Satoshi Nakamoto invented blockchain technology in November 2008 (Nakamoto, 2008). This discovery is known as distributed ledger technology, which is a peer-to-peer distributed asset database that can be used throughout a network of different locations, regions, and institutions, with the ability to overtly validate, register, and convey transactions in unalterable encrypted ledgers (Wang et al., 2019).

Blockchain technology has recently emerged as the primary focus of scientific research and development. Many researchers, developers, and industry practitioners have been drawn to it because of its unique trust and security properties (Courbe & Lyons, 2016). Furthermore, according to some researchers, the decentralized nature of blockchain technology improves the transparency, security of data storage, and transfer in the financial sector because blockchain is viewed as a database containing all transactions carried out between participants since it was created. It is a system that is difficult to hack, and it allows users to bypass the existing complex network of intermediaries required to validate transactions (Tapscott & Euchner, 2019).

Therefore, the purpose of this research is to determine whether Palestine Exchange needs to embrace blockchain technology. However, the literature on blockchain technology is mainly focused on developed and non-Arab countries whereas studies on blockchain technology in the Arab region are still under-explored. And more specifically, not much attention in studies has been given into this context to Palestine.

Furthermore, the Palestine Exchange is considered one of the vital components in the Palestinian national economy since it includes 48 companies are grouped into five sectors: banking and financial services, insurance, investment, industry, and services which are listed in Al-Quds index with a total market capitalization of some USD 3.73 bn.

Palestine Exchange is considered a mirror to the health of the Palestinian national economy. Because it includes the most important and largest companies in Palestine. Furthermore, using blockchain technology in Palestine Exchange can enhance the Palestinian GDP by bringing foreign investments and investors to invest in shares of these companies. That leads to increase the liquidity in Palestine Exchange and improve the performance of listed companies and the Palestinian national economy (Palestine Exchange 2018).

Therefore, this research comes to dig deeper into why Palestine Exchange has to use blockchain technology, what is special about blockchain, what is wrong with the current system, shall we keep the original Palestine Exchange infrastructure in addition to the old or cancel the old form and adopt the new system, finally what can the new system offer to Palestine Exchange and investors, through explaining the way that could help in reshaping Palestine Exchange by using blockchain technology. This research is expected to help the growth of the Palestine Exchange. Furthermore, the findings of this research will assist administrators in determining what should be prioritized while using blockchain to improve the functioning of the Palestine Exchange. The research will aid the researchers in identifying important areas for reshaping the emerging stock exchanges using blockchain technology.

The research begins with an introduction in section 1, then it provides a review of the previous studies in section 2. Section 3 delves into the research methods. The data discussion and results with an explanation of the motives, the feasibilities, the challenges, and the vision of implementation of blockchain technology in Palestine are presented in section 4 of the research paper. The conclusion and recommendations are presented in Section 5.

## 2. Review of the literature

Previous research has primarily focused on the use of blockchain by financial markets in developed countries. This research, on the other hand, focuses on the blockchain in Palestine Exchange as a developing country. This section discusses three topics: the usage of blockchain technology in financial markets, the benefits of adopting blockchain technology in financial markets, and the challenges of implementing blockchain technology in financial markets.

### 2.1. *The usage of blockchain technology in financial markets*

(Bergquist, 2017) define blockchain technology as a database that has primarily been used in the financial sector. It is a stand-alone technique, along with recent computer science developments in safe multiparty computation. The possible applications of blockchain technology in financial markets, according to this research, can be categorized into three categories.

First, payment transactions: traditional payment mechanisms rely on centralized ledgers to record all

transactions and keep track of account balances. As a result, the transaction is sent once from the participating parties to central third-party intermediaries, where it is reviewed for legitimacy, and then both accounts are adjusted by the intermediaries (Ammous, 2016). In contrast, in blockchain technology, a payment transaction is sent to all network nodes and contains several transfers, necessitating greater processing power and time. The transaction then generates as a new block on the blockchain, which is replicated to all members' devices (Ammous, 2016). On the one hand, some scholars believe that incorporating blockchain technology into payment transactions will lower the cost of cross-border transactions, annual operations costs, and risk costs. Furthermore, the privacy and transparency of these transactions will be improved (Kakavand et al., 2017). On the other hand (Ammous, 2016), refers that the use of blockchain technology in the payment process will make it slower and more expensive. According to the various viewpoints presented above, the requirement for all nodes on-chain to authorize a payment transaction increases the time and expense of implementing this procedure. We believe that financial organizations can solve this problem by employing a private blockchain, which limits transactions to a select number of users and allows transactions to be handled more quickly. Furthermore, we suggest that the "lightning network" would overcome this problem by building direct payment channels that collect users, allowing payments to be delivered swiftly and the ultimate net amount to be recorded on blockchain technology.

Second, the clearing and settlement process: some financial experts believe that clearing and settling trades is one of blockchain's most promising applications (Kakavand et al., 2017). The Clearing and Settlement process, according to Ref. (Allen et al., 2013); is the process of transferring securities purchased from the seller's investment portfolio to the buyer's investment portfolio and transferring the price of securities done from the buyer's investment account to the seller's investment account. In the traditional clearing and settlement process, intermediary clearing organizations are still a key component; the process entails several complex steps such as bookkeeping, transaction, reconciliation, balance reconciliation, and payment initiation (Guo & Liang, 2016). (Pilkington, 2016) states that the traditional method is expensive and time-consuming because it relies on cross-border payments, which require a 3-day settlement period. As a result, the inefficiency and a large number of expenditures required are explained. By unifying

multiple components of the clearing and settlement process, blockchain achieves exceptional elegance and efficiency (Kakavand et al., 2017). When a transaction is added to blockchain, it is marked as final, and multiple nodes in the network can verify it at the same time. As a result, employing blockchain in the clearing and settlement process eliminates the need for a third-party intermediary (Pilkington, 2016). According to Ref. (Guo & Liang, 2016); the life cycle of the clearing and settlement procedure will be reduced from several days to a few minutes because the cost of cross-border transactions will be abolished. As a result, the short time would eliminate credit and liquidity risk by requiring pre-funding. Furthermore, by reducing the danger of a purchaser default, transactions are completed more consistently, and clearing members are subject to lower capital requirements (Kakavand et al., 2017).

Third, a blockchain-based board of director voting system: a blockchain-based voting system was invented by the Bitcoin Foundation in February 2015, the blockchain is a type of system that provides high transparency in the voting process, with each vote being recorded under a secure cryptographic hash on the distributed ledger (Millet, 2017). Furthermore, the voting process would be completed using blockchain's inherent transparency, immutability, and consensus. A Danish political party was the first to use blockchain in the voting system for internal election purposes (Millet, 2017). Furthermore, many scholars have discovered that blockchain may be utilized to handle all reporting, compliance, and collateral management, lowering back-office expenditures (Kakavand et al., 2017).

Finally, Asset Tokenization: According to Ref. (Chen, 2018); blockchain tokens can be used to represent a variety of scarce assets other than currency. Furthermore, he claimed that blockchain has enabled inventors to create digital tokens to represent scarce assets, such as equities, debt, derivatives, and real estate, which can then be traded seamlessly on a peer-to-peer network.

## 2.2. *The benefits of adopting blockchain technology in financial markets*

Because various benefits are coming to boost financial development, the financial sector can gain in a variety of ways from the adoption of blockchain technology. Blockchain improves the data's accountability and auditability, which might be quite beneficial (Prieto et al., 2019). Furthermore, public blockchain allows users complete accessibility and universal access. Meanwhile, "blockchain

simplify activities and workflows, cancel embedded paper-based procedures, decrease manual errors, and cost-efficient to operate, support, and enhance” (Chohan, 2017; Prieto et al., 2019).

In addition, most emerging economies lack the infrastructure required for traditional payment networks. In contrast, because blockchain relies on software to function, it may function without a high level of physical infrastructures such as buildings, facilities, equipment, supplies, and employees. This is seen as a significant opportunity (Nguyen, 2016). Moreover, according to Al- Astal (2020), hardware requirements vary by organization but are often not too high because the blockchain node only needs to keep in sync. This is in contrast to mining, which necessitates far greater computational power. With increasingly powerful hardware, blockchain nodes' sync time and performance improvements.

Al- Astal (2020) outlines that blockchain nodes (such as Ethereum) can be run on desktop computers, home servers, single-board computers, or virtual private servers in the cloud, according to the needs and goals of the company. Even though blockchain is often thought of as a single technology, there are two sorts of blockchain implementations: public and private, which will assist determine the hardware requirements for the system. Palestine Exchange may need to use a private blockchain, which would necessitate the installation of three servers to host the blockchain nodes. The blockchain is not simply a transaction and value storage network, but it can also run applications. To create entire system solutions for blockchain applications, the business level needs to strengthen and develop the core blockchain procedures. The Palestine Exchange may have applications for dividend distribution, tokenization, and settlement, among other things, implying that blockchain might serve as a platform for developing and deploying applications. According to Ref. (Chohan, 2017); using blockchain to meet and respond to changing local and global markets, as well as drive further innovation, is beneficial.

### 2.3. *The challenges of implementing blockchain technology in financial markets*

There are numerous types of hurdles that should be considered before implementing blockchain technology. According to Ref. (Nguyen, 2016); mobile payment systems such as PayPal, Google Wallet, and Apple Pay are putting a lot of pressure on blockchain technology (Guo & Liang, 2016). further emphasize that attaining true decentralization is difficult; as a result, disintermediation cannot

be achieved. However, because consortium blockchains and private blockchains are more centralized than truly decentralized public blockchains, many financial institutions have turned to them (Swan, 2015). argues that one of the most important aspects and risks in determining whether blockchain will thrive or fade is government regulation. In contrast (Marr, 2019), stated that a lack of rules is a major issue with value-based blockchain networks and that scams and market manipulation may be frequent as a result of the absence of governmental control (Marr, 2019). states that blockchain has a high-cost environment since it relies on encryption to offer security and generate consensus over a dispersed network. Complex algorithms must be executed to prove that a user has the authorization to write to the chain, which requires a lot of computational power and is expensive to manage. Furthermore, the complexity of blockchain technology, which necessitates the understanding of encryption concepts and algorithms, poses a hurdle in terms of applying this technology (Marr, 2019). (Swan, 2015) explains if all user data is online and the private key is stolen or revealed, the user has no recourse, which could result in a privacy nightmare. Blockchain transactions, according to Ref. (Marr, 2019); could be slow and inconvenient compared to traditional payment methods like cash or debit cards (Swan, 2015). find that, despite the financial sector's strong interest in blockchain technology, public perception of the system's technological nature remains one of the most significant impediments, alongside controversies it is as a venue for money-laundering, drug-related, and other criminal behavior.

## 3. Methodology

### 3.1. *Research design*

This research used a qualitative research methodology to investigate how blockchain technology can be used to reshape the Palestine Exchange. The qualitative method of research is a research method that involves exploring and defining a topic to create a survey instrument for data collection (Merriam & Tisdell, 2015). Furthermore, it generates narrative or textual descriptions of the phenomena under investigation and assists researchers in understanding current dynamics in the field (Bjørnstad et al., 2017). Moreover, because it is a design that is particularly appropriate for the purpose of research, this research used a case study approach. A case study, according to Ref. (Hollweck & Yin, 2015); is “an empirical inquiry that

investigates a contemporary phenomenon (the 'case') within its real-life context, particularly when the boundaries between phenomenon and context are not evident." P 18 (the Supplemental Content can be found here: [https://journals.usek.edu.lb/cgi/editor.cgi?article=1008&window=additional\\_files&context=aebj](https://journals.usek.edu.lb/cgi/editor.cgi?article=1008&window=additional_files&context=aebj)).

### 3.2. Participants

The present research used both convenience sampling and snowball sampling methods to recruit the relevant participants. Professionals and academics who are convenient to the study were identified as part of the convenience sampling strategy. As a result, some respondents who participated in answering interview questions were chosen based on the researcher's knowledge of them, and their selection is complete once they demonstrate a willingness to participate (Vanderstoep & Johnston, 2009). Snowball sampling strategy: After selecting professionals and academics who are relevant to the study's purpose, those respondents are asked to identify others who might be eligible to participate, and this second group of participants is contacted. In turn, those respondents identify other participants (Vanderstoep & Johnston, 2009).

Blockchain technology is relatively new in Palestine, and the number of professionals and academics who have knowledge and experience in this field is limited. Thus, I was only able to interview 12 participants ( $n = 12$ ), which included three professionals who work in the field where the research is being conducted, two academics have chosen for their extensive knowledge and theoretical aspects of the research, two experts who were knowledgeable and aware of the legal

aspects of the research, and due to blockchain technological nature, five IT experts were also consulted.

### 3.3. Interviews

The research aims to collect primary data on Palestine Exchange's adoption of blockchain technology. Therefore, the qualitative approach was conducted. This approach includes three methods such as participant observation, in-depth interviews, and focus groups, which can be used to answer the research question (Mack, 2005). As a result, in-depth interviews method was chosen. The semi-structured interviews were conducted, and the 12 recruited participants were interviewed individually using open-ended questions. Furthermore, we used participant feedback to improve the interpretative validity of the data collection tools. The interviews were conducted in 2020. We conducted online interviews with professionals and academics interested in blockchain technology. At the beginning of the interviews, we explained the purpose of the research and stated that the interviews are intended to broaden the researcher's understanding of blockchain technology and its applications, as well as the implications of the Palestine Exchange.

### 3.4. Data analysis

The data from the interviews were audio-recorded and manually transcribed verbatim. The data for this research was analyzed using the deductive content analysis process, which included the creation of a categorization matrix for each theme. Following a review of all transcripts, the pre-determined codes and categories were used in the

Table 1. Unconstrained categorization matrix.

Categories	Elements to be coded	Codes
Motives for implementing Blockchain technology in the Palestine Exchange.	Security	Forgery, Confidence, Recording data, Centralization.
The method by which Blockchain technology is being implemented in the Palestine Exchange	Bureaucracy	Type, Area, Infrastructure.
The advantages of adopting Blockchain technology in the Palestine Exchange	Applications	
The challenges of applying Blockchain technology in the Palestine Exchange	Environment	Cost-effective, Protection, Reliability, Swiftly administered
The vision of executing Blockchain technology in Palestine.	Economic benefits	Regulations, Computing issues, Acceptance, Planning, Coordinating, Training, Controlling.
The extent of legal compatibility for applying Blockchain technology in Palestine.	Technical benefits	
	Legislative, Technological, and Social environments, Administrative functions	
	Future aspirations	Blockchain future, Future of local cryptocurrency.
	Legal orientations	Existing legislation, Legal instruments, Legal obstacles.

unconstrained matrix to code the transcripts, as shown in [Table 1](#).

Five categories were defined before analysis, with each category containing related sub-categories. The prominent categories are motives for implementing blockchain technology in the Palestine Exchange. In addition to, the method of implementation. Also, the advantages and challenges of adopting this technology. Then, the vision of executing blockchain technology in Palestine.

#### 4. Data discussion and results

The following are some of the directions we have found from the research into the use of blockchain technology by the Palestine exchange. In Palestine Exchange, The motives to embrace blockchain technology are the security concern, lack of consumer confidence, and high bureaucracy. Changes in blockchain application areas are seen as settlement process, tokenization, and dividend distribution. In addition, the type of blockchain should be chosen based on the Palestine Exchange's model of operation and the regulations. Creating a parallel system is also needed in the case of the Palestine Exchange. At the same time, the economic and technical achievements are regarded as the most important benefits supplied to Palestine Exchange. Even though the need for blockchain technology is growing, several obstacles remain in the way of the Palestine Exchange adopting it.

##### 4.1. Motives for implementing blockchain technology in the Palestine exchange

According to the content analysis, the need for Palestine Exchange to adopt blockchain is linked to the availability of motivations for doing so, whereas security concerns, a lack of consumer confidence, and a high level of bureaucracy are all critical factors that motivate Palestine Exchange to use blockchain technology as shown in [Table 2](#).

In terms of security, there are three major challenges that the Palestine Exchange must address: forgery, lack of confidence, and the way data is recorded. Because the old system of the Palestine Exchange relies on paper transactions and the system has not been fully automated, the Palestine Exchange needs to implement blockchain. As a result, this centralized structure can lead to forgery and manipulation, both of which are aided by a lack of transparency. This particularly happens when data is not processed in a peer-to-peer network. Thus, this has a negative impact on investor trust in interacting with the traditional Palestine Exchange system, as well as the system's reputation. Furthermore, the recording, archiving, and processing of data is carried out by a central party in the traditional Palestine Exchange system, whereas blockchain technology records and preserves data without the need for a third party and its related costs. Moreover, blockchain can overcome the possibility of fraud through its immutability feature. Since the transaction cannot be altered once it has been processed entirely, every transaction is

*Table 2. Motivations of implementing Blockchain technology in PEX.*

Sub-Categories	Security			Bureaucracy
	Forgery	Confidence	Recording data	Centralization
Hanan Tubaileh	The process is not entirely automated.	lack of data sharing	Data recording is centralized.	Reliance on paper transactions.
Yahya Al- Salqan	The level of technology reflects the credibility of the company.	lack of data sharing	Depends on the third party.	Waste of time.
Ghassan Shahin	Blockchain is more reliable.	Blockchain non- refutable.	Blockchain allows for secure and safe recording of data.	Waste of time.
Qusay Jouda	The existing system is not open and neutral.	It is controlled by a central entity.	It is not an inclusive system.	Decision making is controlled by a central entity.
Mohammad Abu Baker	The current system does not suffer from forgery.	Technology needs to be constantly updated.	The current way of recording data is costly.	Transactions require more time and efforts.
Bashar Abu Zarour	The transparency in the current system is high.	High level of technology is essential	Depends on the third party (CDS).	Bureaucratic environment.
Nadia Massoud	Blockchain will enhance the transparency	Blockchain allows matching between buyers and sellers.	The current way of dealing with recording data is slow.	Transactions require more time and efforts.
Ahmed Owaida	Blockchain reduces fraud and manipulation.	High risk in the current system	Centralized in recording data	Transactions require more time and effort

recorded and connected to the previous transactions in the form of blocks (Avdza, 2017). By sharing digital transactions in real-time on a peer-to-peer network, blockchain technology can create interconnectedness between buyers and sellers on the chain without a central intermediary, thus providing a secure, verified, and one source of truth that is accessible to all members of the network (Kersten et al., 2017).

We have proposed that the centralized approach to recording and saving data allows for the occurrence of “Asymmetric information,” lowering parties' confidence in the current Palestine Exchange system. However, blockchain is a network of computers with decentralized system management and authorization. The computers on the network function together to validate transactions using predefined rules built into the system. The transaction verification procedure is controlled by all computers on the network, and it is decentralized to eliminate any errors. The computers work together to control system operation and prevent tampering with the ledger's contents, and data is shared across all computers on the network. This functionality allows blockchain to keep a clean, safe database, a stronger control system, and effective confidence among all parties (Dai et al., 2017). Some of the interviewees considered that the existing system of the Palestine Exchange has never had a security problem, that transparency is excellent, and that there is no potential for fraud or manipulation in the current system (Abu Zarour et al., 2020). Consequently, we have differing points of view, the present system's operations need to be more automated to prevent fraud and data manipulation. Transforming the processes from traditional manual services to automated services using different computational informatics will achieve higher efficiency and quality services. Additionally, depending on third parties leads to a lack of basic customer service capability development. However, this can be avoided by utilizing blockchain technology to automate data analysis processes and reduce reliance on expensive experts. In addition, we discovered that in the existing system, relying on intermediaries to purchase and sell stocks on behalf of investors and organizations can increase the risk of forgeries.

In terms of bureaucracy, the old method of Palestine Exchange takes longer to execute transactions and requires more fees and effort. Therefore, the existing centralized system has a high level of bureaucracy and danger. Blockchain technology, on the other hand, replaces a centralized and bureaucratic register with a tamper-proof and autonomous

transactional database system that includes a secure registration and transaction procedure, hence lowering administrative expenses and bureaucracy (Cholewa & Shanmugam, 2017). We believe that using blockchain will improve the performance of the Palestine Exchange because the volume of trading is small and the number of traded stocks is small. Furthermore, installing blockchain technology will increase the market capitalization of Palestine Exchange as a result of increased demand and supply of trading shares in Palestine Exchange by attracted new investors to the blockchain system.

#### *4.2. The method by which blockchain technology is being implemented in the Palestine exchange*

As a result of examining the case of Palestine Exchange, the following are the fields where blockchain is being used the most; settlement process, tokenization, and dividends distribution (see Table 3). Despite the interviewees' recommendations that Palestine exchange can use blockchain in a variety of fields, we believe that the Palestine Exchange should initially begin implementing blockchain technology in the field of the settlement process as a first step. This will enable the Palestine Exchange to cut costs and save time.

The Clearing Depository and Settlement Department in Palestine Exchange is responsible to handle the settlement process, this process takes three days to complete which is T plus 2. So the process is lengthy for any transaction to be settled. However, blockchain technology can do more than just provide the settlement process; it can also add beneficial elements through doing that. If the money is not settled within three days, the account's liquidity vanishes. The funds should be used to fund other operations immediately. Blockchain technology can accomplish this by saving these three days, thereby compensating for the waiting period for settlement. In the traditional settlement, dividends will not be paid to stockholders before the dividends date. Recently, blockchain has made it possible to implement this indefinitely and continuously. Furthermore, listed companies on the Palestine Exchange can tokenize their stocks to raise capital by issuing tokenized shares of digital assets; thus, tokenized stocks take the form of a digital token rather than physical paper.

For a variety of reasons, using a private blockchain is preferable in the case of the Palestine Exchange. The Palestine Exchange is in charge of sensitive transactions. As a result, when using blockchain technology, there must be some level of control.



Table 3. The manner in which the Blockchain technology is established in PEX.

Sub-Categories	Applications		Environment
Codes	Application type	Application area	Infrastructure
Hanan Tubaileh	Private Blockchain	Stock trading	Getting rid of the traditional system gradually
Yahya Al- Salaqan	Based on: type of model and the regulations	local cryptocurrency	Parallel system
Ghassan Shahin	Private Blockchain	Stock- bonds, trading stock shares, keeping track history of stocks, controlling stock trade.	Keeping the old system for a fixed period then get rid of it (Parallel implementation approach)
Qusay Jouda	Hybrid Blockchain	Settlement process.	Integrate new technology in the existing infrastructure carefully
Mohammad Abu Baker	—	Settlement process.	Parallel system
Bashar Abu Zarour	Based on the type of model	Settlement process, Dividends distribution, Organization of the plenary meetings, Voting on the resolutions.	Cancel the old form
Nadia Massoud	Private Blockchain	Settlement process, Dividends distribution,	Create a prototype and test this prototype with a couple of clients, if successful they build the larger and make it to scale.
Omar Qwariq	Hybrid Blockchain	Stock trading	Keeping the old system for a fixed period then get rid of it
Ahmed Owaida	—	Settlement process, Tokenization.	Getting rid of the traditional system gradually

This level is represented by an entity that determines who is a chain participant and allows them to trade stocks. Blockchain's goal is to achieve decentralization. Private blockchain can accomplish this while also maintaining a control entity. For example, if Palestine Exchange uses private blockchain on a hundred devices, there will be no centralization because the data will be recorded and shared on all participants' devices on the chain, resulting in a hundred control entities instead of one. Because blockchain is similar to other technologies and should have high appropriate security, the Palestine Exchange can overcome hacking and security issues once it adopts private blockchain. Palestine Exchange will use a double-entry system on the private blockchain.

In terms of hybrid blockchain, some interviewees thought it was the best option for use in the Palestine Exchange in many ways. For example, it will help broaden its transactions and make them more accessible to the rest of the world. Accessibility while maintaining control is possible with hybrid blockchain. In contrast to hybrid blockchain, private blockchain determines the participants and transactions on the chain. A public blockchain, on the other hand, is completely uncontrolled by competent authorities. We concluded that public blockchain is ineffective for Palestine Exchange because the instructions and regulations governing

banking data in Palestine prevent the open system from being implemented. Furthermore, maintaining control is critical in a sensitive location such as Palestine Exchange. We believe that the form of blockchain should be chosen after defining the type of model, analyzing the participants involved, determining the targeted audience of investors, and taking into account the state's rules and regulations. Therefore, the blockchain form should meet the goals of the Palestine Exchange design. Future research can be conducted on the technical design of the model that the Palestine Exchange can build, along with the selection of the appropriate form of blockchain.

However, when it comes to the nature of the environment in which blockchain technology is used, the interviewees were divided into two camps. The first point of view advocates for the establishment of a parallel system alongside the traditional system in the Palestine Exchange. This can be accomplished by testing it with a few clients. If the new system is successful, the Palestine Exchange will gradually implement it and phase out the old system. The second view argues the Palestine Exchange must eliminate the traditional system once blockchain technology has been implemented. We agree on the first point, which is to carefully integrate new technology into existing infrastructure. The Palestine Exchange is a sensitive

location and the only market in Palestine. As a result, any change or improvement to the system should be carefully considered and researched. Furthermore, any new technology usually goes through several stages before arriving at the final big picture.

#### 4.3. The advantages of adopting blockchain technology in the Palestine exchange

The economic and technological gains are regarded as the most important advantages that blockchain brings to the Palestine Exchange as shown in Table 4. In terms of technical benefits, blockchain offers security and privacy features because the data on blockchain is immutable and encrypted. Changing the information on the chain is a difficult process because the majority of mining servers must accept it. All information on the chain must be accessible to all participants, which takes a significant amount of time. Furthermore, all chain participants have access to all chain information and can

verify the validity of all transactions. Thus, the reliability and degree of protection introduced by blockchain technology to Palestine Exchange are high, and blockchain technology can solve manipulation and forgery because the investor can trace and track everything. Furthermore, this improves the system's trust and transparency.

Blockchain technology enables all participants to have easy access to the chain's information. It is the democratic way of conducting transactions without the need for authority. It also improves the quality of Palestine Exchange transactions and reduces the probability of risks because it allows transactions to be completed instantly. The settlement of Palestine Exchange transactions will be instantaneous due to blockchain. Furthermore, it provides easiness and accessibility. Therefore, when the system in Palestine Exchange becomes more accessible and global, it will entice foreign investors to invest in it, and blockchain technology will allow for greater public trust in the Palestine Exchange.

Table 4. The advantages of adopting Blockchain technology in PEX.

Sub-Categories	Economic benefits	Technical benefits		
Codes	Cost-effective	Protection	Reliability	swiftly administered
Hanan Tubaileh Yahya Al Salqan	Reducing costs Reducing costs through the disposal of intermediaries	Data privacy The data is immutable	Secure environment The democratic way of doing transactions without the need for an authority	Ease of use Elimination of intermediaries
Ghassan Shahin	Removing costs	Non-refutable	Assurance	Ease of access to data
Qusay Jouda	Reducing costs and more liquidity	Privacy of data by using different encryption and hashing techniques to provide for ore private interactions	Ownership of assets is based on cryptography which makes it more secure	It is achieved as an emergent property from the interaction of different participant in a Blockchain network.
Mohammad Abu Baker	Reducing costs	Protect the privacy of all parties	Maintaining rights for its holders by documenting financial transactions.	Ease of access to data
Bashar Abu Zarour	Blockchain is expensive technology since the PEX does not have large scale activities	The data is immutable	–	Expeditious completion of transactions
Nadia Massoud	Reducing costs	High privacy	More security and transparency	Instant transactions, easiness, accessibility, complication
Omar Qwariq	Reducing costs	Data confidentiality	Secure technology	Expeditious completion of transactions
Ahmed Owaida	Reducing costs on participants	Data confidentiality	Reducing risk	More transactions, and more liquidity

In terms of economic benefits, because blockchain allows for instant transactions, it will increase liquidity in the Palestine Exchange. As a result, participants will pay less for transactions. Furthermore, the elimination of intermediaries between buyers and sellers will help participants reduce costs, and when we assume that establishing blockchain will be expensive and time-consuming. The Palestine Exchange can make a model for the potential return on investment from blockchain adoption. However, because Palestine Exchange is a small market, implementing blockchain technology will not be a difficult process, and it will be simple to bring blockchain technology to scale. In addition, the distribution of dividends in the Palestine Exchange is complicated because many investors are missing and Palestine Exchange is unable to reach them. Blockchain technology has the potential to solve this problem because all investors will have accounts on the chain, dividends will be deposited into their accounts. We realized that blockchain technology will be profitable for Palestine Exchange because it allows institutions to operate faster and

cheaper, with a much lower error rate, fewer resulting risks, lower capital requirements, and is less vulnerable to cyber-attacks. By 2022, blockchain technology could globally reduce financial services infrastructure costs by \$15 billion to \$20 billion per year. This allows for the decommissioning of legacy systems and infrastructure, as well as a significant reduction in IT costs (Gregorio, 2017).

#### 4.4. The challenges of applying blockchain technology in the Palestine exchange

Many factors, such as the legislative environment, social environment, technological environment, and administrative issues, can obstruct the implementation of blockchain technology in Palestine Exchange (see Table 5 and Table 6). There is a lot of work to be done on the legal front. This is especially true given the fact that there are very few rules and laws governing blockchain technology applications, that regulators lack sufficient technical knowledge, and that the legal framework governing electronic financial transactions is weak in Palestine.

Table 5. The challenges of applying Blockchain technology in (PEX).

Sub-Categories	Legislative environment	Technological environment	Social environment
Codes	Regulations	Computing issues	Acceptance
Hanan Tubaileh	Lack of technological knowledge by legislators.	Solar energy as an alternative to computer power. Technological infrastructure is available.	Individuals unfamiliarity with Blockchain.
Yahya Al- Salqan	The need for regulations	The computing issues are not a problem	Culture
Ghassan Shahin	The need for a legal framework.	Poor technical infrastructure in Palestine Exchange	Lack of knowledge
Qusay Jouda	few regulations are available	Massive computing power is needed for security	The belief in Blockchain should be solid
Mohammad Abu Baker	The concerned parties should take legal actions	Privacy characteristic of Blockchain	Lack of technical knowledge.
Bashar Abu Zarour	Lack of technological knowledge by legislators.	Cyber-attack protection system require high investment	Lacking sufficient technological and financial awareness by all users
Nadia Massoud	Regulations are not a problem	Building Blockchain is easy	People are uncomfortable with technology.
Omar Qwariq	lack of technological knowledge by legislators.	Solar energy as an alternative. Technological infrastructure is available.	Individuals unfamiliarity with Blockchain
Ahmed Owaida	The need for a legal framework.	–	–
Ali Sartawi	Amendments to Electronic Transactions Act It is not a difficult process to convert a decree into a law.	protection procedures	Craving for technology by youth. Human capital is available
Mohammad Abu Shahab	Decree- Law no 15 of 2017 on Electronic Transactions needs supportive codes. Commercial code no 12 of 1966, and Banking code no 9 of 2010 are outdated.	–	The relevant ministers have shown no interest.

Table 6. The challenges of applying Blockchain technology in (PEX).

Sub-Categories Codes	Administrative functions			
	Planning	Coordinating	Training	Controlling
Hanan Tubaileh Yahya Al- Salqan	Resistance to change. Dealing with individuals technological ignorance.	Coordinate with other parties. Exploit local competencies	Training the staff Training the staff	Approved and ratification. The desire to control by institutions.
Ghassan Shahin	Implementation issues related to the software side.	The need for coordination with PCMA.	The need for human capital.	–
Qusay Jouda	The volatility of Blockchain assets is high.	–	–	The monitoring process more transparent and efficient.
Mohammad Abu Baker	–	Hindering the role of competent authorities for monitoring and coordinating.	Training the staff.	The need for approval by PCMA.
Bashar Abu Zarour	Business continuing plan.	The need for cooperation with supportive companies.	Training the staff and investors.	Approved and ratification.
Nadia Massoud	Having a system with the ecosystem of trading and listing and fundraising to be dynamic.	Collaborative with local computer scientists. Bringing Blockchain to scale.	Training the staff and make them experts.	–
Omar Qwariq	Resistance to change.	Coordinate with other parties.	Training the staff.	Approved and ratification.
Ahmed Owaida	Requiring of the ecosystem.	Collaborative with government, PCMA <sup>a</sup> , PMA <sup>b</sup> , financial system, and legal system.	Training the staff.	Approved and ratification.

<sup>a</sup> PCMA: Palestine Capital Market Authority.

<sup>b</sup> PMA: Palestine Monetary Authority.

Furthermore, the Judiciary's experience with technical issues is limited. Therefore, the government should enact regulations to help organize technological development. This can be accomplished by fostering collaboration among the Palestine monetary authority (PMA), private sector, and public sector. Thus, regulators will welcome those regulations because they provide them with a transparent and secure system. Some interviewees did not consider legal issues as a barrier to using blockchain technology because once implemented, the parties involved will take the necessary legal actions to regulate. We agree that legal aspects can be managed in favor of blockchain technology, and it can be organized similarly to how electronic financial transactions, such as credit card transactions, are currently implemented within financial institutions. Individuals resist change when it comes to the implementation of new technology due to a lack of technological knowledge. As a result, we believe that the government should encourage and support individuals' creative efforts, proposals, and ideas. Furthermore, Palestinian universities should play an important role in educating and enhancing students' technological knowledge.

In terms of the technological environment, the technical infrastructure is determined by the type of blockchain to be used. Public blockchain necessitates very good servers, particularly those that will build mining transactions. Furthermore, when miners want to mine new transactions and list them on their chain on the public blockchain, they must pay fees, which increases the miners' reward. This new transaction will reach a larger number of users faster, and the competition will be fiercer. As a result, this process will increase security, and transactions on public blockchain will not be free. Private blockchain, on the other hand, does not require the mining process to implement transactions, so the servers that will be used do not require any special features. However, the technical level required is not difficult, so after deciding on the blockchain design, consideration is given to the role of hardware and communication networks. The RAM (the device's random memory, or the node), the size of the hard disk's storage space, and the communication network between the node and the other nodes will be the focus of the hardware. Because each node contains a copy of the blockchain (distributed database) and the nodes are decentralized, the size of this communication network is

Table 7. The vision of executing Blockchain technology in Palestine.

Sub-Categories	Future aspirations	
Codes	Blockchain	local cryptocurrency
Hanan Tubaileh Yahya Al- Salqan	Blockchain will change the functions of intermediaries. Globally, adopting Blockchain are increased for reasons democratization of the economy. Palestine is a follower of those economies. Blockchain is going to change the world of economy not only technology like email, social media, is going to reshape the economy in the world.	– There is the capability to issue local digital currency but there is no clear effort on this idea.
Ghassan Shahin	–	Within the COVID-19 pandemic, the PMA is considering the adoption of digital means as an alternative to bank-notes (cash).
Qusay Jouda Mohammad Abu Baker Bashar Abu Zarour	The world is veering towards adopting Blockchain technology. The necessity of keeping up with technological developments. The COVID-19 pandemic is encouraging to using technology, and this opportunity should be exploited.	– Circumstances do not allow this politically and economically.
Nadia Massoud	Stock exchange definitely should adopt Blockchain since the world is veering towards it.	–

determined by the amount of data that will be exchanged. The number and type of nodes used are determined by the size of the design. Nodes are classified into three types; first: The entire node that contains a server with plenty of storage space and RAM. Second: The Light node that has limited storage space and RAM capacity, this type is used by users who do not want to pay more money. Third: The very light node that requires modest devices designed for a specific role, and it cannot track the blockchain in real-time. The cost of the entire node will be minimal, especially in small blockchain networks. Tens or even hundreds of nodes will not be required for the Palestine Exchange. Al Astal (2020) estimated that five to ten nodes would be adequate, with the number of nodes determined by the volume of data processed by the blockchain. This necessitates a technical examination of the situation. Furthermore, Palestine Exchange can be configured to mimic Consensus, “one of the largest blockchain companies,” which invests in talent and offers programs to build developer communities. Because the underlying blockchain programs are not dissimilar to popular programming languages such as Java and Python, the existing programming community can be upskilled to blockchain programming (NITI Aayog, 2020).

The computing power required to run blockchain is not regarded as a problem because only the mining devices necessitate a large amount of power. This problem can be solved by using solar energy to power these servers. Other servers do

not necessitate this level of processing power. Blockchain computing power is distributed across the computer network that is running the blockchain. This means that the total computing power is enormous, which increases the system's security. Establishing this power does not necessitate any initial individual or institutional investment or effort. We believe that by using solar energy, the Palestine Exchange will be able to reduce operating costs. Furthermore, these efforts will increase processing power, system security, and the number of operations completed.

By implementing a private blockchain, the Palestine Exchange can overcome the issue of hacking and security. Blockchain, like any other technology system, requires adequate security. Palestine Exchange will have a double-entry system, and the design will take security, firewalls, and persistent hacking into the account. Palestine Exchange must develop a system that allows users to comprehend the process by which the private key is stored. Investors, not the Palestine Exchange, are responsible for the process of storing the private key. They should seek advice from Palestine Exchange on how to store it. There are numerous methods available today to ensure that the private key remains secure. However, the design of private and hybrid blockchains do not allow for hacking, because the transactions are supervised. Whereas blockchain technology is based on a higher level of security, and the Palestinian government can develop protocols to protect the system from hacking attacks.

In terms of administrative difficulties, Palestine Exchange should take many actions to overcome constraints that impede the adoption of blockchain technology, including opposition to change, ecosystem work, and the need for human capital. It is Palestine Exchange, not the users, who are responsible for the development of blockchain. Experts who understand how transactions are performed and monitored should build the blockchain. This expertise should be trained in locations where the blockchain is well-developed, such as Australia, and a long-term partnership between Palestine Exchange and these countries should be established. The cost of constructing a blockchain is determined by the sort of blockchain design chosen by the Palestine Exchange. Furthermore, Palestine Exchange should provide guidelines for dealing with technologically illiterate individuals, and it should take steps to ensure that software is implemented properly by attracting and retaining skilled personnel. The Palestine Exchange must make blockchain technology simple and accessible to investors and users. This can be accomplished by developing an app that investors can download on their smartphones. The app can include brief instructions or a video that explains the app's primary features and how to utilize them. We discovered that the blockchain experience is still relatively new around the world. As a result, if the Palestinian government took the initiative to deploy blockchain technology, it might amass a wealth of knowledge and provide it as a service to others. In addition, throughout doing this research, we met with several Palestinian professionals who are blockchain experts, some of whom have created their blockchain apps.

#### *4.5. The vision of executing blockchain technology in Palestine*

In terms of the future of blockchain technology adoption in Palestine, the interviewees believe that the technology will continue to grow significantly and will certainly be applied (see [Table 7](#)). In changing economic and democratic situations, there is a global trend toward embracing blockchain technology. Unfortunately, Palestine is a follower of these economies rather than a leader. Keeping up with technological advancements, on the other hand, is a must. This opportunity should be taken advantage of, especially since the COVID-19

epidemic encourages the use of technology. Intermediaries' roles will be reshaped by blockchain. As a result, implementing blockchain necessitates the government's construction of brokerage firm systems and functions. Blockchain, according to Al-Salqan (2020), will transform global economies. Blockchain technology is a tremendously powerful tool that has the potential to transform global economies. While Massoud (2020) stated that stock exchanges should incorporate blockchain because the world is moving in that direction. Furthermore, according to Ref. ([Abu-Ghazaleh, 2019](#)); blockchain will have a long-term impact and is one of the components of the next fourth revolution, dubbed "the knowledge revolution." We believe that using blockchain technology in a country that does not encourage competencies, such as Palestine, takes more time, effort, and collaboration.

In terms of the future of local digital currency, the PMA was exploring the use of digital methods as a replacement for banknotes and cash during the COVID-19 epidemic. Owaida (2020) was in favor of developing a local digital currency, and he saw the need for a digital environment as critical. He further stressed that the PMA has legal and technical guidance in this area, but that it is still in its early stages. While Al-Salqan (2020) stated that the possibility to generate local digital money exists, comparable to what happened in Europe when the electronic Euro was issued and traded among banks. This happened before the Euro was issued in its current form. We see that Palestine is occupied by Israel and that there is no native traditional currency. As in the case of the electronic Euro, this is an excellent chance to construct a digital currency that may be traded on a modest scale at first.

## **5. Conclusion and recommendation**

This research paper investigates how blockchain technology could be used to reshape the Palestine Stock Exchange. Based on data gathered from interviews, the research's findings indicate that the Palestine Exchange should adopt blockchain technology because it suffers from bureaucracy issues, centralization, asymmetric information, and high transaction costs. The findings point to three distinct areas where blockchain technology could be used to solve the Palestine Exchange problem. The settlement process, dividend distribution, and tokenization are the most important fields. Even

though blockchain technology will improve the working mechanisms in these fields, Palestine Exchange should maintain the traditional infrastructure form while adopting the new infrastructure as a parallel system. Furthermore, employing local capabilities to construct a blockchain application is the greatest option for making blockchain a meaningful resource for Palestine Exchange. The findings reveal that the Palestine Exchange should choose the sort of blockchain it will use depending on the model's design, local regulations, and application scope. According to the findings, implementing blockchain technology in the Palestine Exchange will speed up the liquidity cycle while also lowering costs, boosting transparency, allowing for the trading of new goods, and attracting new investors. Furthermore, the process of implementing blockchain technology is suited for third-world countries because it does not necessitate the construction of buildings or infrastructure. (Herko, 2019); on the other hand, stated that blockchain infrastructure is an appropriate answer for transportation problems in low-income cities such as Cape Town, South Africa, and Delhi, India.

The legal and technological concerns of deploying blockchain technology in Palestine Exchange are not seen as roadblocks. These problems can be overcome by Palestine Exchange. According to the findings, updating electronic transaction laws is not a complex process, as it is normally done through presidential decrees that are issued to amend deficiencies in the law. According to the findings, there will be a significant increase in the adoption of blockchain technology around the world, particularly following the COVID-19 epidemic. The recent epidemic drew the attention of the PMA to the use of digital methods as a substitute for banknotes. As in the case of Nasdaq, it is critical to provide a parallel system powered by blockchain technology to the original system of the Palestine Exchange. Furthermore, the field of land registration systems in Palestine needs to implement blockchain technology. Issuing government policy and developing a strategic plan for digital transformation by prioritizing blockchain adoption and launching e-government, such as Saudi Arabia, UAE, and Jordan, is a better way to use blockchain technology. It is necessary to prepare the ecosystem for the successful adoption of blockchain technology, as well as to reform the functions and services of financial intermediaries. Also, current laws governing electronic transactions and electronic crimes should be updated to account for new technological applications.

## Acknowledgements

This accomplishment would not have been possible without my Professor Ziad Zagroul's guidance and feedback throughout writing this research, as well as his encouraging words that gave me the motivation to pursue this work.

## Conflicts of interest

There is no conflict of interest.

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