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Faculty of Business and Economics

Master of Business Administration (MBA)

How to Reshape Palestine Exchange (PEX) by Blockchain Technology (A Qualitative Exploratory Study)

كيفية إعادة تشكيل بورصة فلسطين باستخدام تكنولوجيا البلوكتشين

(دراسة استكشافية نوعية)

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Abstract

The entire world is facing critical technological change and financial markets are not isolated from that. Whereas, Blockchain stand in driving this change bringing with it better efficiency, more transparency and trust, increasing in safety and security, and decreasing costs. The Blockchain technology is still in its initial stages. However, it will have far-reaching applications that are not limited to the financial field.

This research aims to present insight about the implementation of Blockchain technology in Palestine Exchange (PEX) by analyzing the field of Blockchain application in Palestine Exchange (PEX), benefits gained, and the most serious constraints to effective implementation. To achieve the research objectives a qualitative research method base on interviews has been chosen. In particular, the interviews were selected as a tool of collecting the data to investigate how Blockchain technology can reshape Palestine Exchange (PEX), 12 professionals and academics have been selected through using convenience sampling strategy and snowball sampling strategy.

The research initially demonstrates that three factors impact on adopting Blockchain technology (ABT) by Palestine Exchange (PEX) that are: the range, the benefits, and the challenges of adopting Blockchain technology. On this finding, it further proves that the adoption field (AF) has a positive influence of adopting Blockchain technology in Palestine Exchange (PEX). Additionally, the findings have shown that perceived benefits (PB) and perceived usability (PU) also have a positive influence of adopting Blockchain technology by Palestine Exchange (PEX), since that will help in reducing costs, allowing to trade new products, speed liquidity cycle, attracting new investors, disposing of the asymmetric information issue, and many fields can Blockchain technology be applied in like settlement process, dividends distribution, and tokenization.

Abstract (Arabic)

يواجه العالم بأكمله تغيرات تكنولوجية جذرية، حيث أن الأسواق المالية ليست بمعزل عن ذلك. إن تكنولوجيا البلوكتشين تقف في مقدمة هذا التغيير، فهي تهدف لتحقيق كفاءة أفضل، ومزيداً من الشفافية والثقة، وزيادة في الأمن والخصوصية، وكذلك تهديف لتقليل التكاليف. على الرغم من أن تكنولوجيا البلوكتشين لا تزال في مراحلها الأولية، إلا أن تطبيقاتها لن يقتصر على المجال المالي فحسب بل سيمتد إلى العديد من المجالات.

يهدف هذا البحث إلى تقديم نظرة ثاقبة حول تطبيق تكنولوجيا البلوكتشين في بورصة فلسطين. وذلك من خلال تحليل مجالات تطبيق تكنولوجيا البلوكتشين في بورصة فلسطين، والفوائد المكتسبة ، وأهم المعيقات التي تحول دون التنفيذ الفعال لها، ولتحقيق أهداف البحث ، تم اختيار المقابلات كأداة لجمع البيانات وذلك للتعرف على إمكانية إعادة تشكيل بورصة فلسطين باستخدام تكنولوجيا البلوكتشين، فقد تم اختيار 12 متخصصًا وأكاديميًا من خلال استخدام استراتيجية العينة الملائمة و استراتيجية عينة كرة الثلج.

يشير البحث في البداية إلى وجود ثلاثة عوامل تؤثر على اعتماد تكنولوجيا البلوكتشين من قِبَل بورصة فلسطين والتي تتمثل في المجال الذي يستدعي استخدام تكنولوجيا البلوكتشين به، وفوائد استخدامها، وكذلك تحديات تبني هذا النظام بالنسبة لبورصة فلسطين. في الختام، أظهرت نتائج البحث أيضًا أن مجال التطبيق له تأثير إيجابي على اعتماد تكنولوجيا البلوكتشين في بورصة فلسطين. بالإضافة إلى ذلك أظهرت النتائج أن الفوائد المكتسبة وسهولة التطبيق تمتلك أيضًا تأثير إيجابي على قرار تبني تكنولوجيا البلوكتشين من قِبل بورصة فلسطين. نظرًا لأن ذلك سيساعد في خفض التكاليف ، والسماح بتداول المنتجات الجديدة ، وتسريع دورة السيولة ، وجذب مستثمرين جدد ، والتخلص من مشكلة المعلومات غير المتماثلة ، كما يمكن تطبيق تكنولوجيا البلوكتشين في العديد من المجالات مثل عملية التسوية ، وتوزيع الأرباح ، والترميز.

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Definitions of key terms and acronyms

- **Clearing systems:** a group of rules and process whereby the financial institutions introduce and exchange data or documents concerning convey of funds or securities to other financial institutions at one location as a clearinghouse (PMA, 2020).

- **Blockchain:** is a database has emerged fundamentally in the financial sector. It as a stand-alone technology, along with new advances in computer science concerning secure multiparty computation (Bergquist, 2017).

- **Double- spend problem:** The possibility for the user to spend the same money twice. This issue can be resolved by utilizing a trusted third-party (Corluka; & Lindh, 2017).

- **Public key:** The public key is perfectly safe to publish in public, and can only be used to encrypt the message (Corluka; & Lindh, 2017).

- **Private key:** the private key must be kept secret, and can only be used to decrypt a message (Corluka; & Lindh, 2017).

- **Bitcoin:** Decentralized cryptocurrency that can be traded among members in the Blockchain (Antonopoulos, 2014).

- **Consensus by reconciliation:** Is the process that financial markets have selected as their "checks and balances" system whereas the transactions are verified and validated by the counterparty (Nordgren, & Weckstrom, 2019). The peers reconcile their sets using an efficient set reconciliation protocol that is not fault-tolerant but where the complexity is bounded even in the case of failures (Dold, & Grothoff, 2017).

- **Palestine Exchange (PEX):** it is a financial institution that works under the supervision of the Palestinian Capital Market Authority as a public, fully-automated trading platform owned by the private sector (Awwad, 2017).

Chapter I: Introduction

1.1 Overview

Since several thousand years ago, people relied on financial services to satisfy their needs from transferring funds, purchase assets, exchanging bonds and stocks. Therefore, intermediaries have emerged to establish trust and verify identity in a financial transaction (Estelami, 2012). The revolution of financial services changed the way that firms run business, such as the firms of deposits ownership like Carta which is a trustworthy digital form of ownership for security deposits invested in secured assets,[1] and Abu- Ghazaleh Intellectual Property "AGIP" (Abu-Ghazaleh, 2019). Furthermore, the world is going towards adopting the use of technology in many fields, particularly in providing financial services. This attention increased after the Covid-19 pandemic.

Technological innovation plays a significant role, in the evolution of financial services. It has a striking effect on the essence of substantial financial institutions, especially in financial markets. Therefore, stock exchanges all around the world, particularly the US stock market, Nasdaq, and leading Swedish bank SEB are now exploiting how can leverage the technology to overhaul traditional mechanisms and come up with efficient available solutions (Blockchain DuDe, 2018). Remarkably, the Blockchain technology stands ahead of these improvements and has contributed widely to improve many transactions in financial markets. As a result, Nasdaq has teamed up with leading Swedish bank SEB to test a mutual-fund trading platform that will

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[1] https://cartacoin.io/.

run on the Blockchain, and which is intended to speed up and simplify several processes (Manning, 2017).

In November 2008, Blockchain technology was invented by Satoshi Nakamoto[2] (Nakamoto, 2008). This invention is renowned as distributed ledger technology, which is a peer to peer distributed asset database that can be engaged throughout a network of diverse spots, regions, and institutions. With its ability to overtly validate, register and convey transactions in unalterable, encrypted ledgers (Wang; Singgih; Wang; Rit, 2019).

Recently, Blockchain technology has become the main pillar of scientific research and development. Due to its unique trust and security characteristics, it has caught the attention of many researchers, developers, and industry practitioners (PwC, 2020).

Moreover, some researchers have explained that the decentralized nature of the Blockchain technology enhances transparency and security of storage and transfer of data in the financial sector since Blockchain is considered as a database containing all the transactions carried out between participants since it was made up. It is a system that not easy to be hacked, and it authorizes to overshoot the complex network of intermediaries existing required to validate transactions (Tapscott & Euchner, 2019).

This research adopts an approach that is divided into five consecutive chapters. Introduction, Literature Review, Methodology, Data Analysis, and Conclusion. On the one hand, the literature review includes four parts, each part includes three sections. First, it explains the

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[2] Satoshi Nakamoto, this name is called to an unidentified person or a group of people who evolved bitcoin, wrote a white paper about bitcoin, they additionally invented the initial Blockchain database.

development of financial services; its history, definition, and its importance. And will further

elaborate on traditional financial markets; its history, definition, and its importance. Besides, the

research will present an explanation of Blockchain technology; its history, definition, and

characteristics. Then, the research will highlight the using Blockchain technology in financial

markets with focusing the study on the case of Palestine Exchange (PEX); application of

Blockchain technology in financial markets, the benefits of its adoption, challenges that faced its

applying.

1.2 Research problem

Since emerging Blockchain technology, the institutions have opportunities to decrease

costs, increase transparency, and speed many financial transactions, the whole financial

sector is increasingly interested in this technology besides the attention paid by scholars

(Tilooby, 2018). However, the literature of Blockchain technology is mainly focused on

developed and non-Arab countries whereas studies on Blockchain technology in the Arab

region is still under-explored. And more specifically, not much attention in studies has been

given into this context to Palestine.

Moreover, the current methods used by financial markets slow the processes down even

though if the technology allows fast communication, they also push costs up since financial

markets still depend on the " consensus by reconciliation " business model which leaves

opens the risk of disagreement and litigation besides making the processes uncertain. In the

present time, the financial world visibility tends to adopt a more efficient business model in

Blockchain example (Morini, 2016).

In contrast, Blockchain technology can make the stock exchanges more efficient through automation and decentralisation and reduce huge costs levied on customers while speeding up the process for fast transaction settlements. Also, it can improve liquidity, the supply chain optimisation, and increased transparency and trust as a result of the elimination of the third party (The Economic Times, 2018).

Furthermore, the Palestine Exchange (PEX) 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 listed in Al- Quds index with a total market capitalization of some USD 3.73 bn.

Palestine Exchange (PEX) considered a mirror to the health of the Palestinian national economy. That because the Palestine Exchange (PEX) includes the most important and largest companies in Palestine. Furthermore, it enhances the Palestinian GDP by bringing foreign investments and investors to invest in shares of these companies. that lead to increase the liquidity in Palestine Exchange (PEX) 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 (PEX) has to use Blockchain technology, what is special about Blockchain, what is wrong with the current system, shall we keep the original Palestine Exchange (PEX) 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 (PEX) and investors, through explaining the way that could help in reshaping Palestine Exchange (PEX) by using Blockchain technology.

Thus, the problem of this research is summarized in the overarching question which is:

How to reshape Palestine Exchange (PEX) by Blockchain technology in the presence of asymmetric information, high costs, high bureaucracy, and reducing liquidity?

1.3 Research questions

Through the problem statement, we expect to gain insights into the following sub-questions.

- Where can Blockchain be applied in Palestine Exchange (PEX)?

- What are the benefits of the adoption of Blockchain technology in Palestine Exchange (PEX)?

- What are the challenges to Blockchains' applying in Palestine Exchange (PEX)?

1.4 Research objectives

Blockchain represents a recent revolution in the world of financial markets, therefore, the purpose of this research will be to explore how this technology can reshape stock exchanges. And this research will focus on the case of the Palestine Exchange (PEX) at Nablus city. Therefore, the main research objectives represent the following:

1. Identify the aspect that Palestine Exchange (PEX) can apply Blockchain technology in it, more specifically the research aims to investigate whether Palestine Exchange (PEX) need to adopting Blockchain technology.

2. To assess the benefits that Blockchain technology can offer to Palestine Exchange (PEX), and more importantly to explain what is wrong with the current system in Palestine Exchange (PEX).

3. To explain the obstacles and challenges that stand in front of using Blockchain technology by Palestine Exchange (PEX).

1.5 Research significance

The findings of this research will contribute to the benefit of Palestine Exchange (PEX) considering that Blockchain technology plays an important role in the financial sector today. The wide demand for adopting technology in financial institutions justifies the need for applying Blockchain technology. In the Arab world, the UAE was the leader in adopting Blockchain technology in several cases. One of these cases is the Emirates NBD improved the risk and security management process with cheques, and attract new customers by using Blockchain technology (World economic forum, 2020). Thus, the Emirates NBD case could refer to the probability of getting more efficient in financial services and attract new local and international investors once Blockchain technology is implemented by Palestine Exchange (PEX).

Administrators will be guided on what should be emphasized in applying Blockchain to improve Palestine Exchange (PEX) performance. For the researchers, the research will help them uncover critical areas in reshaping Palestine Exchange (PEX) by Blockchain technology.

1.6 Research Scope

Financial markets can be found in different parts of the world. However, this research mainly focuses on Palestine. Mainly, It focus on Palestine Exchange (PEX) which is located in West Bank, Nablus city.

The research takes place during the academic year 2019/2020. In addition, data collection is conducted in 2020 between the 17th of April and 10th May. Data is collected from the literature review of previous studies and from professionals who are working with Palestine Exchange (PEX) and regulators in this field.

1.7 Research structure

This research is organized into five main chapters as follows:

Chapter One: Introduction

This chapter highlights on the general overview; it presents a brief introduction, research problem, research questions, research objectives, the significance of the research, the scope of the research, and an overview of the thesis structure.

Chapter Two: Literature Review

This chapter covers literature related to the financial services and financial markets. Primary the chapter traces the conceptual evolutionary path of financial services, financial markets, and Blockchain technology, and also presents an overview of several definitions of them, later on, it shows their characteristics.

Chapter Three: Methodology

This chapter describes the methodology underlying the research; it discusses the research design, sample for the study, measures, conceptual framework, hypotheses, data collection, data analysis, validity and reliability, and ethical consideration.

Chapter Four: Data Analysis and Discussion

This chapter of the study shows a detailed analysis of the data collected from interviews along with comparison and relationship to previous studies.

Chapter five: Conclusion and Recommendations

The last chapter includes the findings of the study along with their relationship to previous studies and provides the main conclusions and recommendations.

Chapter II: Literature Review

This chapter covers literature related to the progress of the financial sector and Blockchain technology. Primary the chapter traces the conceptual evolutionary path of financial services. Furthermore, it presents an explanation of financial markets. Finally, it provides an overview of Blockchain technology and explains how it has been integrated into financial markets.

2.1 Development of Financial Services

This section covers three parts; the history of development financial services. The second part shows the definition of financial services that explain different view perspectives regarding what is financial services. Finally, the third part provides a brief description of the importance and characteristics of financial services besides its function.

2.1.1 History of Development Financial Services

With speedily changing of the world that we live in, banking and financial services are spreading widely (Rose & Hudgins, 2006). However, in the past several years, the attention in the relationship between financial services and the growth of the economy has already reemerge (Pagano, 1993).

Historically, banking is considered as the earliest of all financial services occupations. Whereas, since more than two thousand years ago the initial bankers were the money changers, they were exchanging foreign coins for local money or replacing commercial notes for cash in

return for free, to assist travellers and facilitate their transactions (Rose & Hudgins, 2006). The first bankers undertook their money to support early ventures. The meanwhile, there was the emergence of attracting deposits from those who have the money and loaning out that same funds to those who need it (Rose & Hudgins, 2006). In contrast, the notion of financial services well spread during the Islamic era and that was clear when prophet Muhammad (Peace be upon him) establish the exchequer of an Islamic state which is a place where funds received by the state, it is the responsible entity for the state's imports and expenditures and the implementation of the legislation. Workers have been hired to supervise and manage these funds to provide financial services (Nawasrah, 2009).

Moreover, with the beginning of the renaissance, the development of overland trade roads and improvements in navigation in the 15th, 16th, and 17th centuries led to plant seeds of the industrial revolution that requested a full-fledged financial system since there was an orientation to the adoption of mass production, which in turn required new approaches for making payments and obtaining credit. Hence the banks were born to satisfy these needs that expanded quickly, the banks progressively spread from Greece and Rome into Europe (Rose & Hudgins, 2006). The first financial service was provided by the initial banks in Europe which is the safekeeping of wealth for a fee (Rose & Hudgins, 2006). Consequently, people in the delivery business realized that saving, transporting money and financial documents from centralized locations were similar to what banks do, therefore, several companies were appeared to present financial services, using their credit and investments to guarantee the movement of funds (Freedman, 2006).

The Financial services passed in three phases; The first transatlantic cable was founded, and the ATM was invented in the first phase (1866-1967), while in the second phase (1967-2008)

financial technology was used to provide financial services, as electronic payments, clearing systems, ATMs, and Internet banking services were provided, and the third phase (2008- present) witnessed the emergence of financial companies that provide financial services directly to consumers (Harfoush, 2019). In addition, it releases a record-keeping system and electronic brokerage services that are widely accepted by consumers (Guendouz, 2019). The volume of domestic and international business was significantly increased as a result of innovations in financial services. These innovations led to the appearance of new business models; Blockchain is one example of these innovations (Nejad, 2016).

2.1.2 Definition of Financial Services

Financial services are conceptually defined as the services that interested in individuals, institutions and their finance, they are services that are focused especially on people's intangible assets as their money or wealth (Ennew; Waite. N & Waite. R, 2013). India - Singapore Comprehensive Economic Cooperation Agreement outlined that financial service is each service of the fiscal type presented by a financial service provider of a specific party (Baijal & Jain, 2006). Additionally, financial services are described as methods of mobilization and distribution of savings that involve all actions engaged in the conversion of savings into investments.

Financial services can also be explained as the goods and services granted by financial institutions for the simplification of different financial transactions and other related activities and can be called financial intermediations (Praveen, 2011). Turner (1996) stated that financial services are an attempt to meet the needs of individuals and organizations that can be measured

in "money" terms, these services are introduced by independent agencies and institutions on an external basis, however, occasionally, organizations may have their specialist divisions that introduce the services internally.

Many studies explained that financial services include a wide range of patterns; direct insurance (life insurance and general insurance), asset management, stock trading, foreign exchange, credit cards, trade finance, venture capital, and banking services (acceptance of deposits and other repayable funds, lending of all types, financial leasing, all payment, and money transmission services, guarantees and commitments, trading for own account or account of customers, participation in issues of all kinds of securities, money broking, settlement and clearing services for financial assets, provision and transfer of financial information, and advisory) (Tamirisa, 2003); (Ennew; Waite. N & Waite. R, 2013); (Baijal & Jain, 2006).

Furthermore, Ennew and Waite (2013) referred to different forms of financial services; the first form that is a contractual relationship between provider and consumers, the second form is a degree of customization. The financial service providers could be natural or juridical persons, this leads to the finance industry which is responsible to provide financial services. The finance industry consists of a large group of organization that treats with these services such as governments, central banks, banks, the monetary authority of a party, credit cards companies, insurance companies, consumer finance companies, stockbrokers, investment funds, mutual funds, and financial intermediaries (Praveen, 2011).

2.1.3 Importance and characteristics of financial services

This section discusses the importance of financial services, then explains the characteristics and functions of financial services.

- Importance of financial services.

During recent years, there has been growing recognition of financial services, this summoned studies to investigate the importance of financial services. The financial services have the greatest importance to the economy of countries. It highly contributes to the countries' GDP. It thus plays a significant role in individuals' luxury (Turner, 1996); (Villiger, 2001). Additionally, the industry could not operate without it, furthermore, financial services can create good operating conditions (Turner, 1996); (Villiger, 2001). Many financial researchers claim that financial services influence positively on the economic growth of the countries through capital formation and conveying savings of the people then channels them into productive investments also financial services promote savings by providing transformation services. Moreover, financial services take part in providing and creating employment opportunities for many numbers of people, subsequently, lead to rising living standards. In addition, financial services' earnings are a vital element in the balance of payments and the provision of liquidity (Turner, 1996); (Rose, & Hudgins, 2006); (Praveen, 2011).

- Characteristics and functions of financial services.

Financial services have some distinguishing characteristics as many other services, this study explains some features that founded by Laux and Tamirisa (Laux, 2017); (Tamirisa, 2003).

- Intangibility: financial services cannot be standardized or reproduced in the same form. Financial services providers should follow customization strategy when presenting these services.

- Invisible: financial services not as goods, it is something moral.

- Inseparability: simultaneously, the production and supply process of financial services performed.

- Not storable: financial services have to be supplied when customers required them and supply of services must meet the demand.

- Variability: the financial services have to be tailor-made to the requirements of customers.

- Financial services are traded through flows of goods, people, information, or money.

The researcher found that advances in technology have a significant impact on the quality of financial services, whereby the competition among financial institutions became highly. Thus, the creative process of financial services and its characteristics is essentially required. Moreover, many studies outline that financial services have several functions. Therefore, many scholars stated that most central functions that performed are the following (Laux, 2017); (Praveen, 2011):

- Achieve growth in the economy during the long term and enable capital formation especially to finance productive investment through transfer savings from household servers and business investors.

- Ensuring larger, faster, and more cost-efficient markets for goods and services through providing a payment system.

- The management of risk by reducing it through aggregation and enabling it to be carried by those more willing to bear it.

- Facilitating transactions in the economy.

2.2 Traditional Financial Markets

In this section, the research provides a brief description of the history of development financial markets, then it discusses the definition of financial markets, finally, it intended to provide the reader with the importance of financial markets.

2.2.1 History of development Financial Markets.

Since the earliest history, people are used to trading commodities and finished goods. However, trading in financial instruments is a new phenomenon. In the Bruges that located in Belgium was the initial recorded trading market for trading financial instruments in a form tavern that was owned by a family named Van der Bourse, this tavern or the physical place was essential for meeting traders together to discover the current value or market price for the financial instruments they were buying and selling (Williams, 2011).

Therefore, the essential economic function is performed by financial markets when transfer funds from those who have surplus funds such as households, firms, and governments to those who have a shortage of funds to finance their spending, the first group are called lenders and the later are borrowers. Hence in financial markets, borrowers borrow money directly from

lenders through selling financial instruments that are claims on the borrower's future income or assets (Mishkin, 2009).

During the last half-century, financial markets in the United States was boomed (Saunders, & Cornett, 2011), it has gotten staggering progress and it turned to technology-driven science besides technology finance, this transformation comes after standing up to the development of finance (Song, Zhang, & Liu, 2020). According to Kuchler (2019), financial markets presented huge progress of innovations with complexity instruments.

However, the pressing development of the financial sector generated eroding in traditional institutional and regulatory arrangements. In addition, this evolution was a reason for developing strong self preferentially and a troublesome degree that is considered as an emancipation from the real economy (Kuchler, 2019). Unparalleled opportunities and challenges are faced by different types of traditional financial markets as money market, insurance market, banking market, and securities market (Song, Zhang, & Liu, 2020).

Furthermore, deep interest has been showing to Blockchain technology in the financial industry and it was considered as a "golden source" since it decreases inefficiencies and costs through allowing various parties to rely on the same information rather than duplicating and replicating it and having to reconcile it, the attention towards technology adoption in financial markets and using of Blockchain technology appears in the Greifeld company example whereas it is integrating Blockchain's distributed ledger technology into NASDAQ'S private markets platform through a platform called NASDAQ Linq (Tapscott, D; & Tapscott, A, 2016).

2.2.2 Definition of Financial Markets

Mantegna (1999) noted that financial markets not only influence the everyday life, but they also encompass huge flows of funds throughout countries' economies, at the same time they affect business profits, production of goods and services, and even the economic well-being of countries. Mishkin (2000) stated that financial markets as well-defined complex systems that took the attention of economists, mathematicians and, recently physicists.

Furthermore, financial markets create a setting in which funds are transferred from people who have a large supply of funds to those who have a shortage (Mishkin, 2000). In contrast, Melicher & Norton (2013) defined that financial markets are both physical and electronic locations that promote the movement of funds among governments, businesses, and investors. The investment location encompasses the trade, marketing, and analysis of securities. It also works on investment risk management by portfolio differentiation.

According to Bradfield (2007) the purpose of a system of financial markets is to allow consumers, investors, and managers of firms to effect shared beneficial intertemporal exchanges. Moreover, Saunders & Cornett (2011) explained that financial markets are structures through which funds flow.

Many financial researchers identified three types of traditional financial markets primary markets, secondary markets, money markets, capital markets, foreign exchange markets, derivatives markets (Song, Zhang, & Liu, 2020); (Saunders, & Cornett, 2011).

2.2.3 Importance of Financial Markets

The occurrences in one market occasionally can influence those in other markets span the world during a few seconds. Therefore, the importance of financial markets such as bond and stock markets comes from its support in promoting larger economic efficiency through directing funds from individuals who do not have a beneficial use for them to those who do (Mishkin, 2007). The high economic growth is a fundamental of smooth operation financial markets, while inefficient functioning of financial markets is the basic element of poor economic of countries (Mishkin, 2007). Moreover, it helps in diminishing the costs of savings mobilization and making easier investments through the most productive technology applications (Allen; Carletti; & Valenzuela, 2013).

According to Allen, Carletti and Valenzuela (2013) domestic bond markets offer continuing funding to both public and private sectors, supply low-cost capital to mature firms and play an important role as an alternative source of funding in the case of banking crises. As a repercussion, global financial markets have become another important financing source for companies in emerging market economies (Allen; Carletti; & Valenzuela, 2013).

Besides, some of the specialists recommended paying attention to financial markets since it facilitates the increase of financial capital. Which is created from issuing debt securities by governments. Thus, ultimately helps to achieve the development goals of countries through finance infrastructures and provided services with high quality to individuals. Corporations can benefit from the financial markets to improve trading debt securities, equity securities, stocks.

As well financial markets could promote the investment process. Furthermore, it simplifies the transfer of securities from current investors to new others (Melicher & Norton, 2013).

2.3: Blockchain Technology

In this section, the research includes three parties, firstly, an explanation of Blockchain history will be presented. Then the research will explain the definition of Blockchain technology, and will further elaborate on characteristics of Blockchain technology and its nature.

2.3.1 History of Blockchain technology.

Since the early days, people have trusted banks to keep their deposits safe. However, the financial crisis of 2008 exposed the breach of customer's trust when the banks lost their customer's money by giving out risky loans. To deal with this problem, the governments printed more money, but people lost trust demanding a currency that would not be controlled by a central authority (Baghla, 2017). Satoshi Nakamoto (2008) considered that trust is a heart issue of a conventional currency that is needed to make this type of currency work. The central bank must be trusted not to debase the currency, but the history of fiat currencies is full of breaches of that trust.

Subsequently of the global financial crisis, several of the recent trends are becoming associated with enhanced freedom and transparency. This allows people to intervene and change the public service system (Nguyen, 2016). Tapscott & Euchner (2019) stated that the digital revolution represents a key instrument to change everything about the way of interaction around

the world, and the technology behind this new revolution is called "Blockchain". Khudnev (2017)

Referred that Blockchain idea has its roots in the 1980s and 1990s from the twentieth century.

Blockchain was firstly developed for the cryptocurrency Bitcoin (Mettler, 2016). In

2008, Satoshi Nakamoto published a paper entitled "Bitcoin: A Peer-To-Peer Electronic Cash

System", the paper described a peer-to-peer version of the electronic cash that would enable

sending online payments directly from one party to another without going through a financial

institution. It argues the challenges of ownership regarding digital currencies and supplies a

solution using a Blockchain before the settlement of a transaction (Grosby; Nachiappan;

Pattanayak; Verma; Kalyanaraman, 2016) (Mettler, 2016).

Bitcoin is a protocol for an electronic payment system based on cryptographic proof

instead of trust, allowing any two willing parties to transact directly with each other without the

need for a trusted third party (Nakamoto, 2008). It also the world's first decentralized public

ledger and it has gained global status around the world (Pilkington, 2016). The success of bitcoin

is stemmed from the cryptographic technology underlying it, namely called Blockchain

technology (Pilkington, 2016).

Recently, the researches on Blockchain not only focus on cryptocurrency, but it has also

focused on a wide scope of applications, and can be used as an infrastructure to support various

innovations as a distributive ledger. The technology could affect several projects in the healthcare

sector (Azaria; Ekblaw; Vieira; &Lippman, 2016). According to Mettler (2016), the potential uses

of Blockchains could prevent drug counterfeiting in the pharmaceutical sector. This is due to the

distinct Blockchain characteristics represented by manage authentication, confidentiality,

accountability and data sharing. In addition, there was a proposal included in "MedRec: Using Blockchain for Medical Data Access and Permission Management", to use Blockchain technology as a decentralized record system to handle EMRs. This is because Blockchain is a distributed system that grants patients comprehensive, immutable log and easy access to their medical information across providers and treatment sites (Azaria, Ekblaw, Vieira, &Lippman, 2016).

Furthermore, many researchers argue that Blockchain is essential for supply chains since Blockchain technology allows transactions that are required to get a product from place to place and it provides transparency to participating companies (Wang, Singgih, Wang, & Rit, 2019).

Lee and Pilkington (2017) explained that Blockchain will allow creating of transparency and new relationships. This will lead to active consumer participation and verify product authenticity and ethical standards. Hence, the transfer and ownership of goods (through cryptography-based transactions) across the supply chain can be traced back on a Blockchain ledger over a peer-to-peer network.

In addition, Blockchain technology can be applied in the land registration process, educational institutions, and Islamic inheritance (Shahin, 2019); (Abu Zarour,2019); (Ahmed, 2018).

According to Khudnev (2017), Blockchain technology has owned 5 main inventions in the last decade which are; bitcoin, Blockchain itself: which enables Bitcoin to be divided from the currency utilized for all types of cooperation, smart contract, proof of stake which removed data centers and replaced them with complex financial tools with similar or higher security level, and finally Blockchain scaling which aims to speed up the process without any threats to security.

2.3.2 Definition of Blockchain technology

The Blockchain is a decentralized data structure, which stores a group of transactions and related data transparently and securely in a distributed network. Network participants can access all historical transactions and their value including the time of the creation of block at any point in time. Furthermore, Blockchain technology is also defined as an inventive technology that has the possible to disrupt current economic and social systems and build higher transparent, efficient, and secure systems. It is a technology that is profound in the globally distributed ledger that reinforces the characteristics of a large peer-to-peer network to verify and approve transactions (D. Tapscott; & A. Tapscott, 2016).

Another definition of Blockchain is a secure, trustworthy and publicly available distributed ledger that contains the transaction history of every Bitcoin in circulation and stores the proof of who owns what at any given point in time. It has the potential to eliminate the necessity for a trusted third party like financial institutions or payment providers (Julita, 2017). The Blockchain also defined as a property of a distributed ledger, it is not dominated by one individual but sustained by many actors (Julita, 2017). This allows strangers who have no personal acquaintance or relationships of trust to construct a trustworthy ledger (Julita, 2017).

Furthermore, Blockchain is invented as a database to hold common unerasable records of all key stakeholders, thereby the reliable of Blockchain technology helps in diminishing costs, reducing settlement risk, and dispose of central points of failure (D. Tapscott; & A. Tapscott, 2016). According to Tilooby; Blockchain technology was presented by Nakamoto to bypass intermediaries that act as a middleman between two parties in financial transactions that by

allowing direct peer to peer transactions (Tilooby, 2018). Fundamentally, the concept of Blockchain refers to the transactions that being collected in Blocks, the chain of these Blocks composes the accepted history of transactions since the initiation of the Blockchain (Avdzha, 2017).

The Blockchain technology can be applied to each digital asset transaction exchanged via online through three steps: Validate Entries, Safeguard Entries, and Preserve Historic Record. However, a Bitcoin transaction can be as an example of explaining how Blockchain technology works. Firstly, X wants to transfer one bitcoin to Y, every person holds a private key and public key.

Consequently, X permits the Bitcoin to be transferred using an encrypted digital signature. The transaction appears as a "Block ". Then, the new Block is broadcasted to each party on a peer to peer network whereas the transaction runs on computers provided by participants all over the world, the risk of hacking does not exist since the centralization is not available in this database. Pursuant to these steps, the participants involved in the network verify and approve the bitcoin transaction and anyone can see it because the transaction remains on the network, not within a specific institution. Following, the new transaction is collected with other old transactions to make a new Block of data for the existing Blockchain. Finally, Y receive one bitcoin from X, and the transaction is recorded (D. Tapscott; & A. Tapscott, 2016); (Crosby, Pattanayak, Verma, & Kalyanaraman, 2016).

(1) X wants to transfer one Bitcoin to **Y**, every person holds a private key and public key.

(2) X permits the Bitcoin to be transferred using an encrypted digital signature. The transaction appears as a " block ".

(3) The new block is broadcasted to each party on a peer to peer network without central institution.

(6) Y receive one Bitcoin from **X**, and the transaction is recorded.

(5) The new transaction is collected with other old transactions to make a new block of data for the existing Blockchain.

(4) The participants involved in the network verify and approve the Bitcoin transaction.

Figure (2.1): How Blockchain works

To be added to the blockchain, each block must contain the answer to a complex mathematical problem created using an irreversible cryptographic hash function. The only way to solve such a mathematical problem is to guess random numbers that, combined with the previous block content, generate a defined result. It could take about a year for a typical computer to guess the right number and solve the mathematical problem. However, due to a large number of computers in the network that are guessing numbers, a block is solved on average every 10 minutes. The node that solves the mathematical problem acquires the right to place the next block on the chain and broadcast it to the network (Al-Astal, 2020).

Blockchain technology has three types that serve to solve different problems as Public Blockchain, Private Blockchain, and Consortium Blockchain (Pilkington, 2016). The main difference between these types is the access permission to the information in Blockchains (Buterin, 2015).

Public Blockchain: this type takes a form of the visible ledger to everybody available on the internet, hence everybody can verify and add a Block of transactions to the Blockchain (Mohanta, Jena, Panda, & Sobhanayak, 2019).
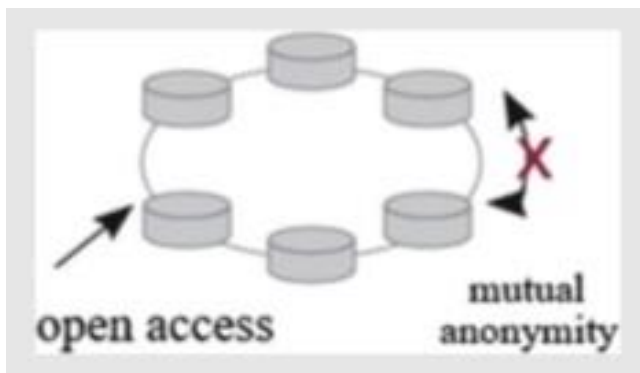
Figure (2.2): Public Blockchain, (Lee, 2019)

Private Blockchain: it has tight authority on the information access thus one party permit consensus process. Furthermore, not every node can be involved in this type of Blockchain since the node will be restricted (Lin; & Liao, 2017).
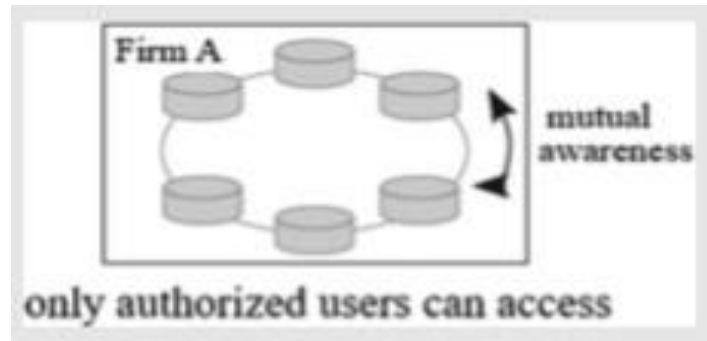
Figure (2.3): Private Blockchain, (Lee, 2019)

Consortium Blockchain: can be defined as the node that has access to the system, the access is granted in advance, and the system is business to business platform. The data on the Blockchain can be public or private, this type considered as partly decentralized such as Hyperledger. (Zheng, Xie, Dai, Chen, & Wang, 2018).
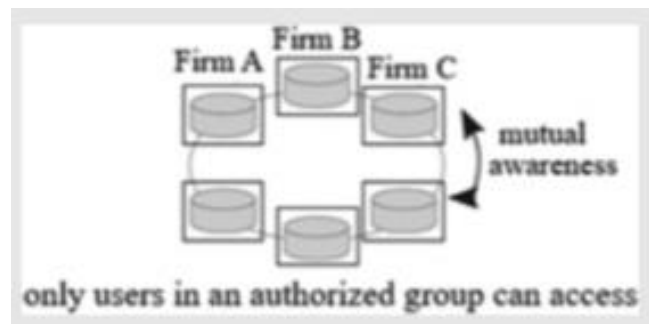
Figuer (2.4): Consortium Blockchain, (Lee, 2019)

Hybrid Blockchain: it brings together the scalability capabilities of a distributed database with immutable Blockchain elements (Andreev, Andreeva, Krotov, & Krotova, 2018).

Financial institutions are especially interested in these private Blockchains since the possibility to store confidential information securely while controlling the access to the information (Economist, 2015). Furthermore, the information and terms in private Blockchains

are easier to change in contrast with public Blockchains. However, transactions and contracts of two kinds cannot be modified or cancelled after they have been verified in public Blockchains (Buterin, 2015).

2.3.3 Characteristics of Blockchain technology and its nature.

The common characteristics of Blockchain technology that recent scholars have discussed, illustrated in the following points.

- Dynamic and fluid value exchange

The Blockchain ledger serves as a permanent record of transactions that take place peer-to-peer or between consumers and an organization. The type of information stored as the Blockchain transactions is not solely limited to a monetary value, such as Bitcoin currency exchange but can span to several uses cases such as the provenance of goods and services, intellectual property rights, user identity data, carbon credits, asset ownership data, location data. This characteristic of the Blockchain value store can make Blockchain technology highly customizable for different applications in multiple industries (Furlonger, &Valdes, 2017).

- Distributed resilience and control

The Blockchain ledger is not controlled by any single organization or entity. Blockchain with distributed database eliminates the need for trusted third parties to verify transactions. It acts as a shared database to provide a secure, verified and single source of truth that is accessible to all members of the network. It also creates trust between parties, increases transparency and confidence in the system (Kersten, Blecker, Ringle, Hackius, & Petersen, 2017).

- Decentralized network

The Blockchain ledger directly connects the individual consumers to the organizations without any central intermediary. The digital transaction data is shared in real-time within the Blockchain's peer-to-peer network. All members of the network keep their local copy of the ledger on their computers and send information to other nodes (Kersten, Blecker, Ringle, Hackius, & Petersen, 2017). It eliminates the need for central authorities, such as banks, as well as trusted intermediaries, such as brokerage firms for value exchange. Further, it reduces friction in current transaction processes and makes the value exchange faster in near real-time while reducing costs. Moreover, due to the massive replication of ledger across several participant nodes, it makes the system more robust as it eliminates a single point of failure in case of any malfunction or collision. It improves quality, reliability, and availability of services (Furlonger, &Valdes, 2017), (Garwal, 2019) Decentralization also increase the level of privacy which is another characteristic of the Blockchain (Avdzha, 2017).

- Privacy

Users (nodes) on the Blockchain do not be identified publicly while entire transactions are comprehensively transparent and traceable (Avdzha, 2017).

- Transparency with pseudonym

The Blockchain-enabled transaction system is highly transparent as every transaction value is visible to every network participant with access rights. It makes illegal transactions very

difficult to execute. However, the participant in the network can choose while initiating a transaction that information related to their identity they are willing to divulge to rest of the network thus providing a pseudonym. For that purpose, each participant node in the network is provided with a private key that is proof of the identity of the node and is used to verify the transaction. The private key should not be disclosed to others because it used to generate the digital signature, which is an alphanumeric code shared with others in the network for transactions (Agarwal, 2018).

- Irreversibility of records

Blockchain uses consensus algorithm to verify a group of transactions and add them to the Blockchain as a block. Thus, it leverages the power of the peer-to-peer network to reach consensus. Thence, when the majority of participants in the network validate a block of transactions, it is added to the Blockchain. If any single party tries to change the ledger, it is unlikely to succeed as the change needs to be verified by a consensus.

In addition, every new block is tied to the previous block, and as soon as a new block is updated all nodes in the network are updated with the latest copy of the ledger. Thus, changing the previous block would be difficult and costly. It makes it hard to change records on the Blockchain, making it immutable (Furlonger, &Valdes, 2017).

- Security and modern cryptography

Blockchain uses public-key cryptography, and digital signatures approach to prove node identity and ensure data security. This approach helps in protecting identities, and preventing data tampering by hackers, reducing the risk of fraud or theft. In addition, by eliminating

centralized third parties, the technology does not result in a single point of failure in case of a compromise (Dickson, 2017).

- Programmable logic

Blockchain transactions are digital, which allows these transactions to tie to conditions written in code. The computation logic can be built only to allow value exchange when certain predefined conditions between the seller and the buyer meet. It allows the transaction to be automated, documented and yet controlled It is the basis for smart contracts in Blockchain technology (Kersten, Blecker, Ringle, Hackius, & Petersen, 2017).

- Immutability

The transaction cannot be altered once it is processed entirely. This is performed by the linkage of each transaction record to the previous transactions in the form of blocks to become a chain (Avdzha, 2017).

2.4: Blockchain technology in financial markets.

This part covers literature related to applying Blockchain technology in financial markets through study the case of Palestine Exchange (PEX). Primary the part focuses the applications Blockchain technology, additionally presents an overview of benefits are achieved of adopting Blockchain technology. Finally, the part discusses challenges that could face financial markets when applying Blockchain technology.

2.4.1 Applications of Blockchain technology in financial markets.

After reviewing previous studies regarding Blockchain technology, this research found that the potential application of Blockchain technology can be divided into three main areas.

Firstly, payment transactions: the traditional mechanisms for payment transactions depend on centralized ledgers for recording all transactions and maintaining account balances. Hence, the transaction is transferred once from the participating parties to central third-party intermediaries, checked for validity, and consequently, the intermediaries adjust both accounts (Ammous, 2016). In contrast, the payment transaction in Blockchain technology is transferred to all network nodes that includes several transferals, thus, it requires additional processing power and time. Subsequently, the transaction becomes a new block on the Blockchain, copied onto all devices of members (Ammous, 2016).

On the one hand, some scholars stated that adopting Blockchain technology in payment transactions will help to decrease the cost of border transactions, annual operational costs, and

cost of risks. In addition, it will enhance privacy and transparency of these transactions (Kakavand, Kost De Sevres, & Chilton, 2017). On the other hand, Ammous (2016) refers that using Blockchain technology in the payment process will make it more slowly and more costly.

According to the different perspectives stated above, the researcher indicates that the need to approve a payment transaction from all nodes on-chain lead to an increase in time to implement this process and costs. Financial institutions can overcome this problem by using a private Blockchain, hence the transactions will be limited to the privately held user group, and then the transactions will be processed faster. Furthermore, the researcher illustrates that using " lightning network " will solve this problem by establishing direct payment channels which collect users, and through it, payments can be quickly sent and record the final net amount on Blockchain technology.

Secondly, Clearing and settlement process: some of the financial specialists claim that clearing and settling trades is one of the most potential application for Blockchain (Kakavand, De Sevres, & Chilton, 2017). Pirrong (2008) defined Clearing and Settlement process as a process of transferring the securities that are purchased from the seller's investment portfolio to the buyer's investment portfolio and transfer the price of securities that are done from the buyer's investment account to the seller's investment account.

However, intermediary clearing companies still the main element in the traditional system of clearing and settlement process, the process includes a group of the complicated steps as bookkeeping, transaction, reconciliation, balance reconciliation, payment initiation (Guo, & Liang, 2016). As a result, the traditional system is costly and lengthy since it depends on using

cross border payments, a remittance requires a 3-day settlement cycle. Thus, this explains the low efficiency and volume of funds needed (Pilkington, 2016).

In contrast, Blockchain technology creates high elegantly and efficiency by integrating several components of the clearing and settlement process (Kakavand, De Sevres, & Chilton, 2017). Once Blockchain technology included a transaction, this transaction will be made up as final, simultaneously many nodes on Blockchain can verify it. Thereby, using Blockchain technology in the clearing and settlement process means to dispense with the intermediary third party (Pilkington, 2016). According to Guo and Liang Blockchain technology will reduce the life cycle of clearing and settlement process from several days to some minutes since the cost of transaction in the cross- border will be eliminated (Guo, & Liang, 2016). Consequently, the short time would remove the risk of credit and liquidity through imposing pre-funding. Additionally, the transactions being finished more reliably and clearing members being subject to lower capital requirements, by decreasing the risk of a purchaser default (Kakavand, De Sevres, & Chilton, 2017).

Thirdly; board of director voting system based on Blockchain technology: a Blockchain-based voting system which was invented by the Bitcoin Foundation in February 2015, the Blockchain is a type of system presents high transparency in the voting process, whereas each vote can be recorded under a secure cryptographic hash on the distributed ledger (Millet, 2017).

Furthermore, the voting process would be completed based on transparency, immutability, and consensus inherent in Blockchain technology. The first usage of Blockchain technology in the voting system for internal election goals was by a Danish political (Millet, 2017).

Moreover, many scholars found that Blockchain technology can be used to handle all reporting, compliance and collateral management, thereby the back-office costs will be reduced (Kakavand, De Sevres, & Chilton, 2017).

Finally; Assets Tokenization: Chen (2018) emphasized that Blockchain tokens can be used to represent a wide range of scarce assets beyond currencies. Furthermore, he stated that Blockchain technology has given innovators the capability of creating digital tokens to represent scarce assets such as equity, debt, derivatives, and real estate and it allows to be smoothly traded on a peer to peer network.

2.4.2 Benefits of adoption Blockchain technology in financial markets.

The financial sector can benefit in many ways from the adaptation of Blockchain technology since many benefits are coming to encourage financial development. Blockchain increases the accountability and auditability of the stored data, and that can be very useful (Prieto, Das, Ferretti, Pinto, & Corchado, 2019).

Moreover, complete accessibility and universal access allowed by public Blockchain for users. Meanwhile, an important benefit of Blockchain technology is "simplify tasks and workflows, cancelled embedded paper-based processes, reduce manual errors, and cost-efficient to operate, support and enhance (Prieto, Das, Ferretti, Pinto, & Corchado, 2019) (Chohan, 2017).

As well most of the emerging economies lack the necessary infrastructure for traditional payment networks. In contrast, Blockchain technology with its features enable it to function without the high level of physical infrastructures such as buildings, facilities, equipment, supplies, and staff since building Blockchain depends on the software, this considered a substantial opportunity (Nguyen, 2016). Moreover, Al- Astal (2020) stated that hardware requirements differ by the organization but generally are not that high since the blockchain node just needs to stay synced. Here we have not to confuse with mining which requires much more computing power. Blockchain nodes' sync time and performance do improve with more powerful hardware.

However, depending on the organization's needs and wants, Blockchain node (such as Ethereum) can be run on desktop computers, home servers, single-board computers, or virtual private servers in the cloud. Although blockchain commonly regarded as a single technology,

there are different types of blockchain implementations: public and private, and this will help to define hardware requirements for the organization. Palestine Exchange (PEX) may need to go with a private blockchain, therefore they may need to install 3 servers to host the blockchain nodes. The blockchain is not only a network for transactions and store of value, but it can also execute programs. The business-level needs a further boost and improve the fundamental blockchain techniques to make complete system solutions to the blockchain applications. Palestine Exchange (PEX) may have applications for dividends distribution, tokenization, settlement process, etc., which means that blockchain can provide a platform to build and use applications (Al- Astal, 2020). Chohan (2017) outlines that adopting Blockchain helps meet and respond to changing local and global markets, and promote further innovation.

2.4.3 Challenges of adoption Blockchain technology in financial markets.

Before applying Blockchain technology, there are several types of obstacles should be given due consideration.

Nguyen (2016) argued that Blockchain technology is facing huge competition from mobile payment systems such as PayPal, Google Wallet, and Apple Pay. Guo and Liang (2016) further emphasized that achieving real decentralization is quite challenging and could even be impossible, therefore, the disintermediation cannot be accomplished. However, numerous financial institutions have come to the consortium Blockchains and private Blockchains since both types are more centralized than completely decentralized public Blockchains (Guo; & Liang, 2016).

Moreover, Swan (2015) stated that government regulation would be one of the most imperative factors and risks in whether Blockchain technology will flourish or disappear. In contrast, Marr (2019) discussed that lack of regulations is considered as a large problem with value-based Blockchain networks, and the scams and market manipulation could be commonplace due to the lack of regulatory oversight.

Marr (2019) described that Blockchain technology has costly environment since it depends on encryption to provide its security as well as create consensus over a distributed network. To evince that a user has permission to write to the chain, complex algorithms must be run, which in turn require large amounts of computing power which are costly to manipulate. Additionally, the complexity of Blockchain technology due to the need to understand the principles of encryption and algorithms that required represent a challenge in front of implementing this technology (Marr, 2019).

Furthermore, privacy challenges for personal records is an important issue to be resolved, therefore if all user data is online and the private key was stolen or exposed, hence, the user just have little recourse, that what means a potential privacy nightmare (Swan, 2015). According to Marr (2019), Blockchain transactions could proceed slowly and cumbersome compared to traditional payment systems, such as cash or debit cards.

Swan (2015) found that despite the huge interest in adopting Blockchain technology from the financial sector, public perception of the Blockchain technological nature still one of the biggest barriers, along with it scandals as a venue for the darknet is money-laundering, drug-related, and other illicit activity.

Chapter III: Methodology

This chapter discusses the methodology underlying the research; it includes four parts: the research design, sample of the research, data collection, and data recording procedures.

3.1: Research design

The research question can be answered by three different qualitative methods such as participant observation, in-depth interviews, and focus groups (Mack, 2005). Therefore, in-depth interviews method was selected because the research aims to gather primary data on adopting Blockchain technology by Palestine Exchange (PEX).

Qualitative methods

Qualitative method research is a method used for research that exploring, defining the topic to create a survey instrument for gathering data (Merriam, & Tisdell, 2015). Additionally, it produces narrative or textual descriptions of the phenomena under study and helps the researchers realize current dynamics within the field (Bjornstad, Harkestad, & Keogh, 2017). The qualitative research provides a richer and more in-depth understanding of the population under study and aims to introduce a range of perspectives and information on the topic (Vanderstoep, & Johnston, 2009).

Case study design

Yin (2014) defined a case study as " an empirical inquiry that investigates a contemporary phenomenon (the 'case ') within its real-life context, especially when the

boundaries between phenomenon and context may not be clearly evident ". Furthermore, Perecman and Curran stated that case study is an experiment to understand a specific person, institution, society, etc., by gathering data about his or its evolution (Perecman, & Curran, 2006). It is the qualitative methods design where the researcher develops an in-depth analysis of the case study by taking into consideration the time and activity limitations. The research conducted this approach since it is a design that particularly fitting to the purpose of the research that set out to investigate how Blockchain can reshape Palestine exchange (PEX).

3.2: Sample of the research

Through reviewing the purposeful sampling technique; the following two strategies were selected to determine the sample of the research.

Convenience sampling strategy: professionals and academics who are convenient to the study were identified. Thus, some respondents who participated in answering the interview questions were selected based on the researcher's knowledge of them, and selecting them is completed once they show a willingness to participate (Vanderstoep, & Johnston, 2009).

Snowball sampling strategy: Initially, the researcher selected professionals and academics who are convenient to the purpose of the study, then those respondents were asked to identify others who might be eligible to participate, this second class of participants was then contacted. Those respondents, in turn, identify other participants (Vanderstoep, & Johnston, 2009).

The researcher conducted in-depth interviews to examine the research questions and explore data related to the case of Palestine Exchange (PEX). Therefore, the researcher has chosen a sample that includes; professionals they work on the area in which the research is being conducted, they are: Ahmed Owaida is an executive director in Palestine Exchange (PEX) he also holds a master degree in economics from St Andrews University in Scotland. Mohammad Abu Baker is a former financial and administrative director in Palestine Exchange (PEX). And Bashar Abu Zarour is a general director of Research and Development directorate in Palestine Capital Market Authority (PCMA), he also holds a PhD in finance from the University of Patras in Greece.

The academics were chosen based on their extensive knowledge and theoretical aspects of the research, they are: Nadia Massoud is a professor of finance in Melbourne Business School, she also founder Carta Business which implements Blockchain technology. And Ghassan Shahin is a professor of E-learning and information systems in Polytechnic University at Hebron.

The researcher also selected a sample that is knowledgeable and aware of the legal aspects regarding the research, they are: Ali Sartawi is a professor of law in An- Najah National University, member of the Ethics and Governance Board of the Eovi, and president of the superintendence of financial institutions in Palestine. And Mohammad Abu Shehab is a professor of commercial law in An- Najah National University and serves a lawyer for a group of allied technology companies.

Due to Blockchain technological nature, IT experts also consulted, they are: Dr. Yahya Al-Salqan holds a PhD in Electrical Engineering and Computer Science from the University of Illinois, the president and CEO of Jaffa.Net- leading software development and outsourcing

company. Qusai Jouda is a Blockchain developer exploring multi-token crypto-economic designs, he holds a Master of Science in Software Technology from the Stuttgart University of Applied Science, was a visiting academic at ETH Zurich. He led Unicef explorations and demystification of Bockchain networks, he designed and presented training sessions on Bitcoin and Ethereum to UNICEF, the World Bank, and the US Department of state. Ashraf AlAstal is a business development expert, Founder of 1plus1.business, he holds Master degree in Business Administration from The Islamic University of Gaza. Also, he is having recognition by Blockchain Council as a Blockchain expert. In addition, Hanan Tubaileh and Oar Qwariq are IT experts in Paltel Company and they are interested in Blockchain technology.[3]

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[3] Appendix (B) illustrates the interviews were conducted to the purpose of the research.

3.3 Measures

The Dependent Variable:

<u>Adopting Blockchain Technology (ABT)</u> was determined as a dependent variable. Thus, the theoretical assumption is that the decision of adopting new technology is specified by three main factors: the adoption field (AF) perceived benefits (PB) and perceived usability (PU).

Independent Variables:

After reviewing the previous literature, the following variables have been determined as independent variables to assess their impact on ABT.

- **The adoption field (AF)**

  Is the range to which a respondent believes that Blockchain technology can be adopted in Palestine Exchange (PEX).

- **Perceived benefits (PB)**

  Is the extent to which a respondent believes that adopting Blockchain technology will enhance Palestine Exchange (PEX) performance.

- **Perceived usability (PU)**

  Is the degree to which a respondent believes that adopting Blockchain technology in Palestine Exchange (PEX) will be free of challenges.

3.4 Conceptual framework

The current research examines the relationships between AF, PB and PU and their influence on the decision of applying Blockchain technology in Palestine Exchange (PEX).

3.5 Hypotheses

The following hypotheses are proposed according to the literature review and research questions:
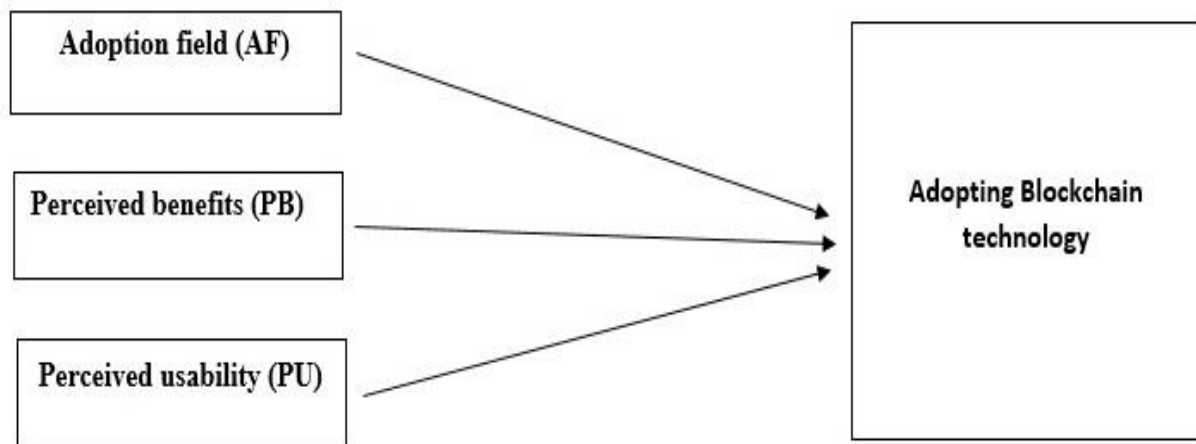
Hypotheses 1: the Adoption field (AF) positively influence on the decision of adopting Blockchain technology in Palestine Exchange (PEX).

Hypotheses 2: there is a positive relationship between the perceived benefits (PB) of Blockchain technology and its adoption in Palestine Exchange (PEX).

Hypotheses 3: there is a positive relationship between the perceived usability (PU) of Blockchain technology and its adoption in Palestine Exchange (PEX).

3.6: Data collection

3.6.1 Literature review

To increase the validity of the research more than one methods are used to gather data, therefore the secondary data is included in the thesis in the form of an extensive literature review. The primary data gathered from interviews while the previous literature studies are used to gather the secondary data. This thesis can create a base for future research to build-up since a little few studies have been written.

3.6.2 In-depth interviews

The researcher conducted interviews by use of structured/opened ended style of interviews[4] to collect information and used participants' feedback to build the interpretative validity of the tools used to collect data. Once the data was gathered the research used coding to analyze and interpret the data.

The interviews were implemented in 2020 between the 17th of April and 10th of May. Therefore, the researcher conducted interviews for one hour via Zoom with professionals and academics interested in Blockchain technology.[5] At the beginning of interviews, the researcher explained the purpose of the research and stated that the interviews will be recorded with keep data confidentiality. These interviews aim to boost the researcher grasp concerning Blockchain technology and its applications and implications of Palestine Exchange (PEX).

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[4] The questions of interviews are appear in Appendix B.
[5] The list of Informants is appear in Appendix A.

3.7: Data Analysis

The deductive content analysis process was used to analyze the data through the development of a categorization matrix based on previous studies and literature review (Elo, & Kyngäs, 2008). Accordingly, the researcher developed the unconstrained categorization matrix before the analysis.

Various steps were involved in the analysis process of data will be explained in detail in the next chapter; firstly, preparing and reviewing all transcripts, then highlighting the essential data, and using predetermined categories and subcategories to code the data. Finally, giving new codes to texts.

3.8 Validity and Reliability

The researcher has utilized different sources of data such as research papers, structured interviews, and case study to deepen knowledge and comprehension the Blockchain technology. To establish the validity of the research; 12 interviews have been conducted in order to provide comprehensive knowledge on the research topic.

3.9 Ethical Consideration

The collected data was handled confidentially. The interviewees were informed that the collected data will be solely used for research purposes. The different views have been approached objectively without excluding or bias to any perspective because answers were

reported as given. Using selected material was accomplished without any form of manipulation

to the information.

Chapter IV: Data Analysis and Discussion

This section introduces deep interpreting and explanation of the data collected from interviews and previous studies.

Qualitative data analysis

To analyze the interviews, deductive content analysis method was used, and the researcher developed a categorization matrix for every theme. There was a review of all transcripts, subsequently, the predetermined codes and categories were used in the unconstrained matrix to code the transcripts as illustrated in the table (4-0).

Table 4-0: Unconstrained Categorization Matrix		
Categories	**Elements to be coded**	**Codes**
Motivations of implementing Blockchain technology in Palestine Exchange (PEX).	Security Bureaucracy	Forgery, Confidence, Recording data, Centralization.
The manner in which the Blockchain technology is established in Palestine Exchange (PEX).	Applications Environment	Type, Area, Infrastructure.
The advantages of adopting Blockchain technology in Palestine Exchange (PEX).	Economic benefits Technical benefits	Cost-effective, Protection, Reliability, Swiftly administered
The challenges of applying Blockchain technology in Palestine Exchange (PEX).	Legislative, Technological, and Social environments, Administrative functions	Regulations, Computing issues, Acceptance, Planning, Coordinating, Training, Controlling.
The vision of executing Blockchain technology in Palestine.	Future aspirations	Blockchain future, Future of local cryptocurrency.
The extent of legal compatibility for applying Blockchain technology in Palestine.	Legal orientations	Existing legislation, Legal instruments, Legal obstacles.

Six categories were defined before analyzing along with each category constituting related subcategories, the prominent categories are; motivations of implementing Blockchain technology in Palestine Exchange (PEX) or problems that required implementing Blockchain technology in Palestine Exchange (PEX), the manner in which the Blockchain technology is established in Palestine Exchange (PEX), the advantages of adopting Blockchain technology in Palestine Exchange (PEX), the challenges of applying Blockchain technology in Palestine Exchange (PEX), the vision of executing Blockchain technology in Palestine, and the extent of legal compatibility for applying Blockchain technology in Palestine. The interviews codes created are shown in Table 4-1, Table 4-2, Table 4-3, Table 4-4, Table 4-5, and Table 4-6, the tables will be analyzed compare to relevant literature.

4.1: Motivations of implementing Blockchain technology in Palestine Exchange (PEX).
   (Problems that required implementing Blockchain technology in PEX)

Four codes "Forgery, Confidence, Recording data, and Centralization "were determined for

"Motivations of implementing Blockchain technology in Palestine Exchange (PEX)" as shown in

the table (4-1):

Table 4-1: Motivations of implementing Blockchain technology in PEX (Problems that required implementing Blockchain technology in PEX)			
• Why Palestine Exchange (PEX) has to use Blockchain technology? • What is the problem that faces the current system in Palestine Exchange (PEX) and requires to apply Blockchain technology? • What is special about Blockchain technology?			
Sub-Categories	Security		Bureaucracy
Codes	Forgery	Confidence	Recording data	Centralization
Hanan Tubaileh	The process is not completely the automate.	lack of sharing data.	Centralized in recording data.	Reliance on paper transactions.
Yahya Al- Salqan	The level of technology reflects the company's credibility.	lack of sharing data.	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, basically after COVID 19.	Depends on the third party (CDS).	Bureaucratic environment.
Nadia Massoud	Blockchain will enhance the transparency of the current system.	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 can reduce fraud and manipulation.	High risk in the current system	Centralized in recording data	Transactions require more time and effort

Note: The header row has an extra column; "Sub-Categories" row shows Security spanning Forgery/Confidence/Recording data and Bureaucracy over Centralization.

The content analysis suggests that the necessity of adopting Blockchain technology in Palestine Exchange (PEX) is attached to the availability of motivations for that, whereas the security issue, lack of consumers' confidence, high bureaucracy are critical factors that motivate Palestine Exchange (PEX) to use Blockchain technology.

Regarding the security issue, the majority of interviewees agreed upon three main issues that require treatment in Palestine Exchange (PEX) these issues are: forgery, lack of confidence, and the manner in which data is recorded. Some interviewees explained that the Palestine Exchange (PEX) has to implement Blockchain technology since the traditional system of Palestine Exchange (PEX) depends on paper transactions and the system has not been automated completely. Therefore, this centralized system can lead to occurring forgery and manipulation, which are both enhanced by lack of transparency, this is especially true in cases in which data is not executed in a peer to peer network. (Al-Salqan; Tubaileh, 2020). Thus, this negatively influences on investor confidence in dealing with the traditional system of Palestine Exchange (PEX) as well as on the system credibility (Al-Salqan; Tubaileh; Massoud;& Qwariq, 2020). Furthermore, in the traditional system of Palestine Exchange (PEX) the recording, archiving, and processing of data is implemented by a central party, contrastingly Blockchain technology which records and maintains the data without need of the third party with its associated incurred costs (Al-Salqan; Tubaileh; Abu Zarour; Abu Baker; & Massoud, 2020).

However, Blockchain can overcome the possibility of fraud through its immutability feature. Since the transaction cannot be altered once it has processed entirely, every transaction is recorded and connected to the previous transactions in the form of blocks (Avdzha, 2017). Blockchain technology can create interrelatedness between buyers and sellers together on the

chain without a central intermediary through sharing the digital transactions in real-time on the peer to peer network, therefore it provides a secure, verified and one source of truth that is accessible to all members of the network (Kersten: Blecker: Ringle. Hackius: & Petersen, 2017). Thus, it is evident that the nature of Blockchain technology enhances transparency, increase trust between players, and confidence in the system of Palestine Exchange (PEX).

The researcher has proposed that the centralized approach in recording and saving data allowed the occurring of "Asymmetric information"[6], thus the confidence of parties in the current system of Palestine Exchange (PEX) is affected adversely. However, Blockchain is decentralized system management and authorization to a network of computers. The computers on the network together verify transactions under prespecified rules that have been embedded in the system. All computers on the network control the transaction verification process, and the process is decentralized to eliminate any error. The computers jointly supervise system operation and prevent the information in the ledger from being tampered with, and sharing the data is carried out among all computers on the network. Through this feature, Blockchain can maintain a clean, secure database, a strengthened control system and effective confidence by all parties. (Dai, Jun; Wang, Yunsen; Vasarhelyi, Miklos, 2017).

Some of the interviewees considered that Palestine Exchange (PEX) never had a security problem with the current system, whereas the transparency is high and there is no possibility to fraud and manipulation in the current system (Abu Zarour; Abu Baker; & Massoud, 2020).

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[6]. Asymmetric information happens when one party has greater knowledge than other parties in an economic transaction possesses.
In Palestine Exchange (PEX) the process of buying and selling stocks is done through financial intermediaries, and the data of investors is recorded and saved by the central entity which is Clearing, Depository and Settlement Dep (CDS).

Consequently, the researcher disagrees about view since the processes in the current system need to be more automated for preventing fraud and manipulate data. Transforming the processes from traditional manual services to automated services using different computational informatics will achieve higher efficiency and quality services. Automated processes require big data and expertise in data analysis. Also, relying on third parties and result in the lack of development of core customer service competency. However, the overcome on that can be done by using Blockchain technology to automate the data analysis processes and reducing the reliance on costly experts (Li; Guo; Wang; Guan; Barenji; Huang; & Chen, 2019). Also, the researcher found that relying on the intermediaries to do the buying and selling stocks on behalf of investors and organizations in the current system can increase the potential for forgery.

In term of Bureaucracy, all of the interviewees pointed out that the transactions take longer to complete the transactions and require more costs and effort in the traditional system of Palestine Exchange (PEX). Therefore, the current centralized system leads to the high bureaucracy and high risk (Al-Salqan; Owaida; Tubaileh; Abu Zarour; Qwariq; Shahin; Abu Baker; & Massoud, 2020). In contrast, Blockchain technology replaces centralized, and bureaucratic register with a tamper-free and autonomous transactional database system that comprises a secure registration and transaction process hence reducing administrative costs and bureaucracy (Cholewa, & Shanmugam, 2017).

The researcher considers that adopting Blockchain technology will enhance the performance of Palestine Exchange (PEX) since the volume of trade is small and the number of

traded stocks is low[7]. In addition, implementing it will grant Palestine Exchange (PEX) higher

market capitalization, as a result of growing demand and supply of trading shares in Palestine

Exchange (PEX) by the attracted investors to the Blockchain system.

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[7]. Palestine Exchange. (2020). Retrieved 13 June 2020, from https://web.pex.ps/

4.2: The manner in which the Blockchain technology is established in Palestine Exchange (PEX).

Three codes " Application type, Application area, and Infrastructure " were identified for "The manner in which the Blockchain technology is established in Palestine Exchange (PEX) "as illustrated in the table (4-2):

Table 4-2: The manner in which the Blockchain technology is established in PEX.			
- Where can Blockchain be applied in Palestine exchange (PEX)? - How can Blockchain be applied in Palestine exchange (PEX)? - What is the type of Blockchain technology more suitable to the case of Palestine Exchange (PEX)? - Shall we keep the original Palestine Exchange (PEX) infrastructure in addition to the old or cancel the old form and adopt the new system?			
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 |

The researcher asked about two factors; first: Blockchain applications that contain two elements, the type and the area of applying. Second: the nature of the environment that will involve Blockchain technology.

Regarding applications type; some interviewees consider that private Blockchain more convenient to the case of Palestine Exchange (PEX) for many reasons. The Palestine Exchange (PEX) deals with sensitive transactions. Therefore, when applying Blockchain technology there must be a level of control. This level is represented in an entity that determines who are participants on the chain and permits them to trade stocks (Tubaileh, 2020). The aim of Blockchain is achieving decentralization. A private Blockchain can achieve this along with maintenance of a control entity. For instance, if Palestine Exchange (PEX) applies private Blockchain on one hundred devices, there is no centralization since the data will be recorded and shared on all participants' devices on the chain, hence, instead of one control entity, there will a hundred control entities (Qwariq, 2020).

Massoud (2020) stated that once the Palestine Exchange (PEX) adopt private Blockchain, it can overcome hacking and security issues because Blockchain is similar to other technology and should have a high suitable security. In the private Blockchain, Palestine Exchange (PEX) will have a double-entry system.

Concerning hybrid Blockchain, some of the Interviewees considered this type as an optimal option to be applied in Palestine Exchange (PEX) for many motives. For expanding its

transactions and to be accessible to the world. The hybrid Blockchain allows for accessibility while retaining control. Private Blockchain in contrast to hybrid Blockchain determines the participants and their transactions on the chain. Whereas, a public Blockchain does not have any degree of control by competent authorities (Qwariq; & Jouda, 2020).

However, others argued that the Palestine Exchange (PEX) should define the type of model, analyze the participants involved, determine the targeted audience of investors, and should take into consideration the rules and regulations of the state (Al- Salqan; Abu Zarour, 2020).

The researcher found that all of the interviewees agreed that public Blockchain is not suitable for Palestine Exchange (PEX) since the instructions and regulations concerning banking data in Palestine prevent the implementation of the open system. In addition, maintaining control is essential for a sensitive place as Palestine Exchange (PEX). The researcher believes that the form of Blockchain should be selected based on the design of the model. This design will be implemented by Palestine Exchange (PEX). The reason for this is that each form has its scope of application. Therefore, the form of Blockchain should meet the goals of the Palestine Exchange (PEX) design.

On the other hand, the interviewees have proposed that Blockchain technology can be implemented by Palestine Exchange (PEX) in several fields such as stocks trading, keeping track history of stocks, controlling stock trade, organization of the plenary meetings, voting on the resolutions, dividends distribution, local cryptocurrency, tokenization, and settlement process.

From the content analysis of the interviews, the researcher suggests that the Palestine Exchange (PEX) has to select the field of the settlement process as an initial step to begin implementing Blockchain technology. The settlement process is done by Clearing, Depository, and Settlement Department (CDS), and it takes three days to clear completely. Three days are the bottleneck which is T plus 2, thus the process long for any transaction to be settled.

Some of the interviewees stated that Blockchain promises instant settlement. However, Blockchain technology cannot only provide the settlement process but it can also add beneficial elements (Massoud, 2020). Massoud and Owaida argued that when the money has not settled for three days the liquidity of the account disappears. The money should immediately finance other operations. Blockchain technology can achieve that through cancelling these three days thus it compensates for the waiting period for the settlement (Massoud; & Owaida, 2020). Before the dividends date, the owners of the stocks will not be able to gain dividends. Recently, this can be implemented constantly and continuously by using Blockchain technology (Massoud, 2020).

Furthermore, the listed companies in Palestine Exchange (PEX) can tokenize their stocks to raise capital by issuing shares of digital assets as a token, hence, tokenized stocks has the form of a digital token rather than physical paper (Owaida, 2020).

However, When it comes to the nature of the environment that contains Blockchain technology, the interviewees were divided into two different views. The first view support the creating a parallel system along with the traditional system in Palestine Exchange (PEX). This can be done by testing it with a couple of clients. If the new system is successful, the Palestine Exchange (PEX) will gradually implement and will get rid of the traditional system (Massoud; Abu

Baker; Owaida; Qwariq; Al- Salqan; Shahin; & Jouda, 2020). The second view argues the Palestine Exchange (PEX) must eliminate the traditional system once Blockchain technology has been implemented (Abu Zarour, 2020).

The researcher agrees on the first view, which aims to integrate the new technology in the existing infrastructure carefully. The Palestine Exchange (PEX) is a sensitive place and the only market is existing in Palestine. Therefore, any change and improvement of the system should be well-considered and studied. Also, any new technology usually passes many phases to reach the final big picture.

4.3: The advantages of adopting Blockchain technology in Palestine Exchange (PEX).

Four codes " Cost-effective, Protection, Reliability, and Swiftly administered " were defined for

"The advantages of adopting Blockchain technology in Palestine Exchange (PEX) " as look in the

table (4-3):

Table 4-3: The advantages of adopting Blockchain technology in PEX.				
• What is Blockchain perceived benefit to Palestine Exchange? • What can the new system offer to Palestine Exchange (PEX) and investors?				
Sub-Categories	Economic benefits	Technical benefits		
Codes	Cost-effective	Protection	Reliability	swiftly administered
Hanan Tubaileh	Reducing costs	Data privacy	Secure environment	Ease of use
Yahya Al Salqan	Reducing costs through the disposal of intermediaries	The data is immutable	The democratic way of doing transactions without the need for an authority	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

According to the interviewees, Blockchain technology can provide advantages of Palestine Exchange (PEX). The economical and technical gains are considered the central benefits. In terms of technical benefits, several interviewees consider that Blockchain technology provides security and privacy features because the data on Blockchain technology is immutable and designed in an encrypted manner (Tubaileh, Abu Zarour, Qwariq, Abu Baker, Owaida, Al- Salqan, Shahin, & Jouda, 2020). Changing the information on the chain is a difficult process because it must be accepted by the majority of mining servers. All information on the chain must be accessible to all participants and this needs a lot of time. Also, all participants on the chain have access to all information on the chain and they can be able to verify the validity of all transactions. Thus, the reliability and the degree of protection which is introduced to Palestine Exchange (PEX) by Blockchain technology is high. Furthermore, this enhances the trust and transparency in the system (Tubaileh, Owaida, Abu Baker, Qwariq, Al- Salqan, Shahin, & Jouda, 2020). Blockchain technology can solve manipulation and forgery because the investor can trace and track everything (Massoud, 2020).

Blockchain technology allows all participants smooth access to the information on the chain. It is the democratic way of doing transactions without the need for authority. It also improves the quality of Palestine Exchange (PEX) transactions and decreases the probability of risks, because it allows to achieve transactions instantly (Tubaileh, Abu Zarour , Owaida, Ab Baker, Qwariq, Al- Salqan, Shahin, & Jouda, 2020).

Massoud (2020) suggests that Blockchain technology will improve the speed of transactions. Settlement of Palestine Exchange (PEX) transactions will occur instantly or in an hour. Moreover, Blockchain technology provides easiness, accessibility. Therefore, when the system in Palestine Exchange (PEX) become accessible and global, it will attract foreigners to invest in it. The publicity and marketing of Palestine Exchange (PEX) are insufficient. Thus, public confidence is low and Blockchain technology allows to enhance public confidence (Massoud, 2020).

With respect to the economic benefits, most of the interviewees' opinions were in support of adopting Blockchain technology since doing transactions instantly will increase the liquidity in Palestine Exchange (PEX). As a result, the transactions will be less expensive to participants. In addition to this, the elimination of intermediaries between buyers and sellers will help reduce costs incurred by participants. Abu Zarour (2020) stated that building Blockchain will be expensive and costly. He also stated that the existing system is sufficient for the volume traded in Palestine Exchange (PEX). In contrast, Massoud (2020) explained that building Blockchain can be costly, so Palestine Exchange (PEX) have to make a model for what potential return for the stock exchange. However, Palestine Exchange (PEX) is a small market, hence applying Blockchain technology will not be a complicated process and easy to bring Blockchain technology to scale. (Massoud, 2020).

The researcher found that Blockchain technology will be profitable for Palestine Exchange (PEX), since this technology enables institutions to operate quicker and cheaper, with a far lower error rate, less resulting risks, lower capital requirement, and is less vulnerability to cyber-attacks (Gregorio, 2017). Blockchain technology could decrease financial services infrastructure cost between US$15 billion and $20 billion per annum by 2022. This provides the

possibility to decommission legacy systems and infrastructure, and significantly reduce IT costs (Gregorio, 2017). Even though the Palestine Exchange (PEX) charges a fee. However, implementing Blockchain technology will speed the liquidity cycle, thus, more funds will be available, more transactions will occur, new products will be traded, and new investors will be attracted.

Furthermore, the dividends distribution is very complicated, since many investors are missing and Palestine Exchange (PEX) is not able to reach them. Blockchain technology has the ability to solve this issue because all investors have accounts on the chain and the dividends will be deposit into their accounts (Massoud, 2020). However, one of the disadvantages is that people are not comfortable with the technology, such as the older, its difficult to convince them to comfort with all thing in the technology. Now, most of the trading requires computers and this is a big deal. Furthermore, most of the dividends distribution usually distributed to superannuation (Massoud, 2020).

The researcher suggests that building Blockchain can be in a way that allows old people of investors and other investors to have their app on the phone, so every investor will have their app on Blockchain to facilitate dividends distribution. Moreover, dealing with technology as a user, not as a computer programmer will be easy for old people.

4.4: The challenges of applying Blockchain technology in Palestine Exchange (PEX).

Seven codes (Regulations, Computing issues, Acceptance, Planning, Coordinating, Training, and Controlling) were specified for "The challenges of applying Blockchain technology in Palestine Exchange (PEX) " as represented in the table (4-4):

Table 4-4: The challenges of applying Blockchain technology in (PEX).							
• What are the challenges of applying Blockchain technology in Palestine Exchange (PEX)? • Do you think that applying Blockchain technology by Palestine exchange (PEX) will hinder the monitor process of Palestine Capital Market Authority on its process?							
Sub-Categories	Legislative environment	Technological environment	Social environment	Administrative functions			
Codes	Regulations	Computing issues	Acceptance	Planning	Coordinating	Training	Controlling
Hanan Tubaileh	Lack of technological knowledge by legislators.	Solar energy as an alternative to computer power. Technological infrastructure is available.	Individuals are not familiar with this type of technology.	Resistance to change.	Coordinate with other parties.	Training the staff	Approved and ratification.
Yahya Al-Salqan	The need for regulations to organize that.	The computing issues are not a problem	Culture of society	Dealing with individuals technological ignorance.	Exploit local competencies	Training the staff	The desire to control by institutions.
Ghassan Shahin	The need for a legal framework.	Poor technical infrastructure in Palestine Exchange (PEX).	Lack of knowledge	Implementation issues related to the software side.	The need for coordination with PCMA.	The need for human capital.	----------
Qusay Jouda	There are very little rules, laws or common taxonomy/terminology around Blockchain and its applications in the real world.	Computing power is huge for increased security of the system.	The belief in such systems should be high enough to allow for cryptocurrency stability	The volatility of Blockchain assets is high.	----------	----------	The monitoring process more transparent and efficient.

Mohammad Abu Baker	Once Blockchain applied, the concerned parties will take the necessary legal actions that regulate using it.	Privacy characteristic of Blockchain technology.	Lack of technical knowledge.	--------	Hindering the role of competent authorities for monitoring and coordinating.	Training the staff.	The need for approval by PCMA.
Bashar Abu Zarour	Lack of technological knowledge by legislators.	The need for high investment in cyber-attack protection system.	Lacking sufficient technological and financial awareness by internal parties and external users concerning Blockchain technology.	Business continuing plan.	The need for cooperation with supportive companies.	Training the staff and investors.	Approved and ratification.
Nadia Massoud	Regulations are not a problem, they can be organized as another transaction in banks	Building Blockchain not challenge.	People not comfortable with technology.	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	lack of technological knowledge by legislators.	Solar energy as an alternative. Technological infrastructure is available.	Individuals are not familiar with this type of technology.	Resistance to change.	Coordinate with other parties.	Training the staff.	Approved and ratification.
Ahmed Owaida	The need for a legal framework.	----------	-----------	Requiring of the ecosystem.	Collaborative with government, PCMA[8], PMA[9], financial system, and legal system.	Training the staff.	Approved and ratification.

[8] PCMA: Palestine Capital Market Authority.
[9] PMA: Palestine Monetary Authority.

Many factors can prevent the implementation of Blockchain technology in Palestine Exchange (PEX) such as the legislative environment, social environment, technological environment, and administrative issues.

The interviewees indicated that regulators do not have sufficient technical knowledge and the legal framework of electronic financial transactions is weak. Furthermore, the experience of the Judiciary regarding technical issues is limited (Tubaileh, Shahin, Abu Zarour, Owaida, & Qwariq, 2020). Jouda (2020) stated that much work needed to be done on the legal aspects. This is especially true since very few rules and laws regarding Blockchain technology applications are existing. However, he believed that these issues are not permanent and can be changed.

Therefore, the government should establish regulations to organize technological development. This process can be done by building cooperation among the PMA, private sector, and public sector (Al- Salqan, 2020). Thus, the regulators will welcome those regulations because it provides them with a system that is transparent and secure (Massoud, 2020). Abu Baker (2020) did not consider legal issues as a barrier to using Blockchain technology because once Blockchain is applied the concerned parties will take the necessary legal actions to regulate.

The researcher agreed that legal aspects can be managed in favour of Blockchain technology, and it can be organized like any electronic financial transactions are presently implemented within financial institutions, such as credit cards.

When it comes to the social environment, the lack of technological knowledge drives many to resist change regarding the implementation of new technology (Al- Salqan, 2020).

The researcher suggested that the government should support individuals creative efforts, proposals, and ideas. In addition, Palestinian universities should have a significant role in educating and enhancing technological knowledge among students.

Some of the interviewees explained that individuals are not familiar with Blockchain technology (Tubaileh, Shahin, & Qwariq, 2020). For example, older people do not prefer the uses of advanced technology whereas, the younger generation is more enthusiastic (Massoud, 2020). Furthermore, Jouda (2020) stated that in order to establish a stable Blockchain technology and the high volume of economic activity in Palestine, the people must understand its usage, features, and benefits.

Regarding the technological environment, Al- Salqan (2020) stated that the technical infrastructure depends on the type of Blockchain that will be used. Public Blockchain requires very good servers especially the servers that will be mining transactions. Furthermore, when miners want to mine new transaction and to list it on their chain on the public Blockchain, they must pay fees, and thus the reward of miners will increase. This new transaction will reach many users faster and the competition will be higher. Hence, this process will enhance security and for this reason, the transactions on public Blockchain is not actually for free. In contrast, private Blockchain does not require the mining process to implement the transactions, therefore, the servers that will be used do not require special features (Al Astal, 2020).

Shahin (2020) explained that the Palestine Exchange (PEX) has poor technical infrastructure and the implementation issues related to the software side is poor. While Tubaileh and Qwariq (2020) stated that the current technological situation in Palestine is well established

and can easily implement Blockchain technology. Furthermore, Palestine Exchange (PEX) can benefit from the data centre of Paltel Company. However, Al Astal (2020) explained that the technical level which is required is not complex, thus after choosing the design of Blockchain, the attention is paid towards the role of hardware and communication networks. In hardware, the focus will be about: the RAM (the device's random memory or what is called the node), the size of the hard disk's storage space, and the communication network between the node and the other nodes.

This communication network depends on the volume of data that will be exchanged because each node will contain a copy of the Blockchain (distributed database) and the nodes are decentralized. The number and type of nodes depend on the size of the design. There are three types of nodes: The entire node; contains a server with large storage space and excellent RAM. The Light node; less storage space, less RAM capacity. This kind is used by users who do not want an increase in cost. The very light node; it requires modest devices designed for a specific role, it can not track the Blockchain instantly.

Al Astal (2020) believed that the entire nodes will not be costly, especially in small Blockchain networks. In the case of Palestine Exchange (PEX), tens or even hundreds of nodes will not be needed. He estimated that five or ten nodes can be suitable and the number of nodes would depend on the volume of data being processed by the Blockchain. This requires a technical study of the case. Furthermore, Palestine Exchange (PEX) can be made to simulate Consensys " one of the large Blockchain companies " which invests in talent and provides programs to build developer communities. The existing programming community can be upskilled to Blockchain

programming, since the underlying Blockchain programs are not very dissimilar to the popular programming languages such as Java and Python (NITIA Aayog, 2020).

On the other hand, the computing power to operate Blockchain technology is not a problem, because only the devices that are used for mining require a huge volume of power. This issue can be solved by utilizing solar energy for running these servers (Al Astal, Tubaileh, & Qwariq, 2020). Other servers do not require this processing power (Al- Salqan, 2020). Jouda and Abu Baker (2020) clarified that the computing power of Blockchain is distributed across the computers network that is running the Blockchain. This means that the complete computing power is huge which increases the security of the system. Establishing this power does not require start individual investment or institutions effort.

The researcher suggested that by utilizing solar energy the Palestine Exchange (PEX)will be able to cut operating expenses. Moreover, these efforts will enhance processing power, increase the security of the system and the number of achieved operations.

Nevertheless, Tubaileh and Qwariq (2020) stated that the design of private and hybrid Blockchain does not allow to be hacked because the transactions are supervised. In addition, Al-Salqan (2020) pointed out that Blockchain technology is built on a higher level of security. Abu Zarour (2020) referred to drafting protocols by the Palestinian government that aim to protect the system against hacking attacks. However, there are no single digital transactions has been hacked on Blockchain technology because the time is not visible (Al-Salqan, Tubaileh, & Qwariq, 2020).

Massoud (2020) explained that the Palestine Exchange (PEX) can overcome the hacking and secure issue by adopting private Blockchain. Blockchain as any technology system should have proper security around. Palestine Exchange (PEX) will have a double-entry system and the security, firewall, and relenting hacking will be taken into consideration in the design. Palestine Exchange (PEX) needs to create a system that enables the users to understand the process in which the private key is stored. The process of storing the private key is the responsibility of investors and not the Palestine Exchange (PEX). Palestine Exchange (PEX) should advise them how to store it. Nowadays, there are many ways to ensure that the private key remains secure.

When comparing the Blockchain system with the bank account, bank accounts are insured. For example, if somebody hacks the client's account, the client is insured since there is insurance. However, this insurance is expensive and can be costly (Massoud, 2020).

The researcher found that the Palestine Exchange (PEX) should duplicate the banking system in regard in the way that banking system deals with hackings. In addition, Palestine Exchange can make simulate to Gemalto SafeNet Authentication Service (SAS) which secures the entire Blockchain network through; ensuring strong identities and authentication where the identities of all participants are known, and securing core Blockchain technologies by using and storing the crypto keys (DIS, 2018).

In term of administrative issues, there are several steps that Palestine Exchange (PEX) should follow to overcome obstacles that hinder the application of Blockchain technology, these obstacles include resistance to change, work in the ecosystem, and the need for human capital. The responsibility of building Blockchain lays with Palestine Exchange (PEX) and not on the users.

Blockchain should be built by experts, who understand how transactions are processed and how to monitor them. these experts need to be trained in areas where the Blockchain is established such as Australia, and ongoing collaboration should created between Palestine Exchange (PEX) and these countries (Massoud, 2020). Blockchain can be built easily by experts, the cost of building Blockchain depends on the type of Blockchain of design the Palestine Exchange (PEX) once to adopted.[10] (Massoud, 2020).

Furthermore, Palestine Exchange (PEX) should formulate instructions to deal with individuals technological ignorance, it must act to ensure good implementation of software through attracting and retaining competent staff. (Abu Zarour, Abu Baker, Al-Salqan, Tubaileh, & Qwariq, 2020). Palestine Exchange (PEX) needs to make the Blockchain technology easy and convenient for investors and users. This can be done by creating an app that investors can install on their smartphones. The app can contain brief instructions or video explaining the main features and how it can be used. (Shahin, Al-Salqan, Massoud, Abu Baker, Tubaileh, & Qwariq, 2020).

Palestine Exchange (PEX) has to collaborate with Palestinian experts such as computer scientists, engineers instead of depending on external resources. Palestine Exchange (PEX) should take advantage to utilize the Palestinian capabilities and resources. Additionally, the local competences have a broader understanding of the local situation (Al-Salqan, Massoud, Owaida, & Sartawi, 2020). However, Abu Zarour and Qwariq (2020) referred to the necessity of presence

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[10] Prof. Nadia Massoud is founder of Carta Company. She built the prototype of Blockchain with its app for her business its costed 45,0000$.
See https://cartacoin.io/.

foreign companies that specialist in Blockchain technology to provide substantive and technical support.

The researcher found that the Blockchain experience around the world still a new one. Therefore, if the Palestinian government was an initiative in implementing Blockchain technology, it can build great knowledge and introduce this knowledge as a service to others. Furthermore, in the course of writing this research, the researcher has explored several Palestinian professionals who are experts in Blockchain and some of them have developed their own Blockchain applications.

4.5: The vision of executing Blockchain technology in Palestine

Two codes " Blockchain, and local cryptocurrency " were defined for "The vision of executing

Blockchain technology in Palestine" as appear in the table (4-5):

Table 4-5: The vision of executing Blockchain technology in Palestine		
• Will there be a future of adopting Blockchain technology in Palestine? • Will there be an expansion of implementing Blockchain technology? • Do you think that there is an orientation of local digital currency and can be traded in the Blockchain technology?		
Sub-Categories	Future aspirations	
Codes	Blockchain	local cryptocurrency
Hanan Tubaileh	Blockchain will change the functions of intermediaries.	--------
Yahya Al- Salqan	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	The world is veering towards adopting Blockchain technology.	------------
Mohammad Abu Baker	The necessity of keeping up with technological developments.	------------
Bashar Abu Zarour	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.	----------

Omar Qwariq	Applying Blockchain requires the development of brokering companies systems.	Trading of Bitcoin is refused by PMA.
Ahmed Owaida	Blockchain technology will come to us, whether we accept or reject it.	There is an orientation related by PMA.

Concerning the future of adopting Blockchain technology in Palestine, the interviewees believed that Blockchain technology will witness further substantial expansion and will be implemented inevitably (Owaida, 2020). Globally, there is an orientation towards adopting Blockchain technology for economic democratic reasons. Unfortunately, Palestine is not an initiative state, it is a follower of these economies (Al- Salqan, & Jouda, 2020).

However, there is an urgent need for keeping up with technological developments (Abu Baker, 2020). Particularly since the COVID-19 pandemic is encouraging the use of technology, and this opportunity should be exploited (Abu Zarour, 2020). Tubaileh (2020) stated that Blockchain will change the functions of intermediaries. Therefore, applying Blockchain requires the development of brokering companies systems and functions by the government (Qwariq, 2020).

Al- Salqan (2020) explained that Blockchain will change the economies of world. Blockchain technology is a very powerful technology that has the ability to reshape the economies of the world. While Massoud (2020) clarified that stock exchanges definitely should adopt Blockchain since the world is veering towards it.

The researcher found that the attentions regarding the digitalization by private and public sector over the world are increasing. Moreover, Abu-Ghazaleh (2019) clarified that

Blockchain will have long term influence and it is one of the components of the next fourth revolution "The knowledge revolution". However, applying Blockchain technology by a country that does not encourage competencies as Palestine, requires more time, effort, and cooperation.

In term of the future of local digital currency, the analysis shows a divergence of views, some of the interviewees stated that within the COVID-19 pandemic, the PMA is considering the adoption of digital means as an alternative to bank-notes/ cash (Shahin, 2020). Owaida (2020) supported issuing a local digital currency, and he considered it an urgent need to establish a digital environment. Also, he clarified that the PMA has legal and technical orientation in this regard, but it still in the initial stage. While Al-Salqan (2020) explained that there is the capability to issue local digital currency similar to what took place in Europe when it issued the electronic Euro to be traded among banks. This occurred before issuing the Euro in its current state.

In contrast, Abu Zarour and Qwariq (2020) explained that the current political and economic situation does not allow the issuing of digital currency in Palestine. The researcher disagrees with this opinion, since the status of Palestine is under the Israel occupation, and has no local traditional currency. This builds a good opportunity to create a digital currency to be initially traded on a small scale as the case of the electronic Euro.

4.6: The extent of legal compatibility for applying Blockchain technology in Palestine.

Three codes " Existing legislation, legal instruments, and legal obstacles " were defined for "The extent of legal compatibility for applying Blockchain technology in Palestine" as appear in the table (4-6):

Table 4-6: The extent of legal compatibility for applying Blockchain technology in Palestine.			
• Do you think that the current regulations, such as commercial code no 12 of 1966, banking code no 9 of 2010, decree-Law no 15 of 2017 about electronic transactions encourage implementing new technological systems like Blockchain technology? • How does the judiciary handle dispute cases resulting from electronic financial transactions? • What are the obstacles that facing applying Blockchain technology as a new technology in Palestine, are they legal obstacles? • Are there Arab countries that are legally advanced in preparing the work of the Blockchain technology other than is the case in Palestine, and where have these countries reached?			
Sub-Categories	Legal orientations		
Codes	Existing legislation	Legal instruments	Legal obstacles
Ali Sartawi	Decree-Law no 15 of 2017 on Electronic Transactions, Commercial code no 12 of 1966, and Banking code no 9 of 2010 are outdated.	Implement strategic plans for digital transformation. E-Government Project.	Legal framework, Technical framework, Protection procedures. Act to amend Electronic Transactions Decree-Law, it is not a complex process. Craving for technology by youth. Human capital is available for implementing Blockchain technology.
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 building of an effective legal system for adopting Blockchain technology.	There is no interest from the relevant ministries. The need for restructuring the legal system. Development of legal systems is a complex process.

Regarding the current laws regulating technological issues, Al-Sartawi (2020) believes that the Presidential Decree No. 15 of 2017 on Electronic Transactions ("Decree on Electronic Transactions") is necessary for light of the current technical development and that it is important to amend the current laws of electronic transactions and electronic crimes to be comprehensive for new technical applications. This is because technology continues to develop rapidly every day. Al-Sartawi (2020) believes that amending the electronic transactions laws should not be difficult as it is usually done through Presidential decrees that are issued to amend deficiencies in-laws. Since the Palestinian Legislative Council is not operating right now, a Presidential decree is issued to amend previous laws. Al-Sartawi (2020) also noted that if the gap between technological development and laws is too large to be included in an amended law, laws must be changed to become compatible with and be responsive to the various changes. Otherwise, the laws will be useless.

On the other hand, Abu Shehab (2020) believes that electronic transactions law needs supporting laws as this law merely deal with the conclusion and formation of electronic contracts. Any gaps in this law are filled by referring to " The Journal", which is the Civil Code of the Ottoman Empire and is very old. In addition, the relevant ministries such as the Ministry of Economy, the Ministry of Telecommunication and Information Technology, and the Ministry of Justice did not seek to activate the electronic transactions law or enhance its implementation. Further, the Palestinian Trade Act No. 12 of 1966 and the Palestinian Evidence Law No. 4 of 2001 are both very old laws, and the Palestinian Presidential Decree on Banking No. 9 of 2010 suffers from a large deficit.

Abu Shehab (2020) explained that the electronic transactions law can be considered a cornerstone, but a strong legal support system is required to meet the needs of technological developments. Abu Shehab (2020) recommends that the financial legal system be completely restructured. This process, however, is difficult in light of the current political circumstances. To achieve restructure, the following is required: the Parliament to become in operation, reconciliation, transparency, recruitment of experts, encouragement of law faculties, and approval by the joint Israeli-Palestinian legal committee on the new law.

The researcher found that issuing a Presidential decree to amend the Decree on Electronic Transactions No. 15 of 2017 to be inclusive of technological developments is not difficult, as Article 43 of the Amended Basic Law of 2003 stipulates that the Palestinian President has the right to issue a decree in the state of necessity due to the disruption of the Palestinian Parliament. The researcher believes that the technological developments witnessed by the Palestinian society in all areas are issues of the critical need for legal regulation to protect the rights of individuals. For example, properly regulating the Blockchain technology will cause the field of electronic transactions to expand and the percentage of transactions to increase. This will create a variety of transactions which will support the Palestinian economy by, among others, benefiting the state's revenues in general, and the institutions' revenues in particular; delivering services to a larger group of people and eventually achieving the financial inclusion plan. Also, the use of Blockchain technology will contribute to reducing government expenditures. Finally, if the Palestinian government does not take an initiative to regulate and adopt the use of the Blockchain technology, international foreign companies will invade the Palestinian market, which will cause major problems for the Palestinian economy.

Al-Sartawi (2020) clarified that some Arab countries such as Jordan, Saudi Arabia and the UAE launched the e-government project to provide quick services to individuals, with less effort, and less cost, as well as providing a foster environment to encourage creativity and innovation under government supervision and to protect innovators from legal prosecutions. On the contrary, Palestine is yet to deal with the issue of digital transformation as a priority in the government's strategic plan. The private sector outperforms the government in dealing with new technologies, and several banks have notably given attention to the topic of digital transformation in their strategic plans.

Regarding legal obstacles, Al-Sartawi (2020) explained that the lack of a legal environment that supports technology is one of the reasons that constitute an impediment to the application of Blockchain technology. For the implementation of the Blockchain technology to succeed, a new law must be established and an appropriate legal environment is created. On the other hand, there should be a solid technical environment because the Blockchain technology will remain limited and need improvement without proper support from all sectors. Therefore, the government must adopt the Blockchain technology as a part of its policy. This should receive great attention, especially that the majority of Palestinian youth gives great attention to technology.

Chapter V: Conclusion and Recommendations

This chapter includes an overview of the findings of the research and presents key conclusions and recommendations.

5.1: Conclusion

The researcher has investigated how to reshape Palestine Exchange (PEX) by Blockchain technology. The findings in the research show that the Palestine Exchange (PEX) need to adopt Blockchain technology because it suffers from bureaucracy problems, centralization, asymmetric information, and high costs issues. The findings suggest three different fields for utilizing Blockchain technology to solve the Palestine Exchange (PEX) problem. The most important fields are settlement process, dividends distribution, and tokenization. Even though Blockchain technology will improve the mechanism of work in these fields, Palestine Exchange (PEX) should keep the traditional infrastructure form along with adopting the new infrastructure as a parallel system.

Additionally, the findings show the best choice to build a Blockchain application by utilizing the local competencies who enable Blockchain to be a valuable resource of Palestine Exchange (PEX). The findings show that the Palestine Exchange (PEX) should determine the type of Blockchain which will be adopted based on the design of the model, the local regulations, and the scope of application. The findings indicate that applying Blockchain technology in Palestine Exchange (PEX) will speed the liquidity cycle, reducing costs, increasing transparency, allowing to trade new products, and attracting new investors. Also, the process of adopting Blockchain technology is suitable for third world countries since it does not require buildings

and infrastructure. Whereas, Herko outlined that Blockchain infrastructure is a suitable solution for transportation problem in low-income country cities such as Cape Town -South Africa, and Delhi- India (Herko, 2019).

The legal and technological aspects are not found as obstacles in front of implementing Blockchain technology in Palestine Exchange (PEX). Palestine Exchange (PEX) can overcome these issues. The findings refer that the amending of the electronic transactions laws is not a difficult process, as usually done through presidential decrees that are issued to amend deficiencies in-laws.

The findings refer that further substantial expansion will happen in adopting Blockchain technology around the world, specifically after COVID-19 pandemic. The last pandemic paid the PMA attention towards adopting digital means as an alternative to banknotes.

5.2: Recommendations

From the findings of this research, the researcher suggests several recommendations to take into consideration.

1- The necessity of introducing Blockchain technology by Palestine Exchange (PEX) to investors in a way that allows them to have their app on the phone.

2- The necessity of providing a parallel system running by Blockchain technology with the original system of Palestine Exchange (PEX) as the case of Nasdaq.

3- The necessity of implementing Blockchain technology in the field of land registration systems in Palestine.

4- The necessity of adopting Blockchain technology as government policy and develop a strategic plan to digital transformation with putting it on the top priority of this plan and launching e-government such as Saudi Arabia, UAE, and Jordan.

5- The necessity of preparing the ecosystem to the success of adopting Blockchain technology.

 6- The necessity of amending the current laws of electronic transactions and electronic crimes to be comprehensive for new technical applications.

7- The necessity of reform the financial intermediaries functions and services.

8- The necessity of issuing local digital currency by the PMA for trading it locally, like what happened with Europe when it issued the electronic euro to be only traded among European banks.

9- The necessity of providing solar energy farms by the government for power generation for running the Blockchain technology, this will save several expenditures and environmentally friendly.

10- The necessity of simulation the way of banking system deals with the hacking attacks, and protection issues.

11- The necessity of cooperating with local competences in building the Blockchain technology of Palestine Exchange (PEX) like Carta Company in Australian which exploit its local competences.

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Appendix A: List of Informants

Master Thesis, Faculty of Business and Economics
Birzeit University
Topic: How to Reshape Palestine Exchange (PEX) by Blockchain Technology (A Qualitative Exploratory Study)

#	Name	Title	Sector	Institution	Country
1	Nadia Massoud	Professor of Finance	Academia	Melbourne Business School	Australia
2	Bashar Abu Zarour	General director	Financial Services	Palestine Capital Market Authority (PCMA)	Palestine
3	Ghassan Shahin	Professor of E-Learning and Information Systems	Academia	Polytechnic University in Hebron	Palestine
4	Mohammad Abu Baker	Former financial and Administrative director	Financial services	Palestine Exchange (PEX)	Palestine
5	Qusay Jouda	Blockchain developer	Software Technology	Stuttgart University	Germany
6	Yahya Al-Salqan	President & CEO	Software Technology	Jaffa. Net Software	Palestine
7	Ahmed Owaida	Executive Director	Financial Services	Palestine Exchange (PEX)	Palestine
8	Hanan Tubaileh	Computer engineer	Software Technology	Paltel	Palestine
9	Omar Qwariq	IT expert	Software Technology	Paltel	Palestine
10	Ali Sartawi	Professor of law, Member of the Ethics and Governance Board of the Eovi Foundation in Bahrain, & President of the superintendence of	Legal	An- Najah National University	Palestine

		financial institutions in Palestine			
11	Mohammad Abu Shahab	Professor of commercial law & Lawyer for a group of allied technology companies	Legal	An- Najah National University	Palestine
12	Ashraf Y. Al-Astal	Senior Consultant/ Visiting Lecturer.	Software Technology	1 plus 1 Blockchain Company, and Gaza Universities.	Palestine

Appendix B: Interview Guide
Master Thesis, Faculty of Business and Economics
Birzeit University
Topic: How to Reshape Palestine Exchange (PEX) by Blockchain Technology (A Qualitative Exploratory Study)

- Why Palestine Exchange (PEX) has to use Blockchain technology?

- What is the problem that faces the current system in Palestine Exchange (PEX) and requires to apply Blockchain technology?

- What is special about Blockchain technology?

- Where can Blockchain be applied in Palestine exchange (PEX)?

- How can Blockchain be applied in Palestine exchange (PEX)?

- What is the type of Blockchain technology more suitable to the case of Palestine Exchange (PEX)?

- Shall we keep the original Palestine Exchange (PEX) infrastructure in addition to the old or cancel the old form and adopt the new system?

- What is Blockchain perceived benefit to Palestine exchange?

- What can the new system offer to Palestine Exchange (PEX) and investors?

- What are the challenges of applying Blockchain technology in Palestine Exchange (PEX)?

- Do you think that applying Blockchain technology by Palestine exchange (PEX) will hinder the monitor process of Palestine Capital Market Authority on its process?

- Will there be a future of adopting Blockchain technology in Palestine?

- Will there be an expansion of implementing Blockchain technology?

- Do you think that there is an orientation of local digital currency and can be traded in the Blockchain technology?

- Do you think that the current regulations, such as commercial code no 12 of 1966, banking code no 9 of 2010, decree-Law no 15 of 2017 about electronic transactions encourage implementing new technological systems like Blockchain technology?

- What are the obstacles that facing applying Blockchain technology as a new technology in Palestine, are they legal obstacles?

- Are there Arab countries that are legally advanced in preparing the work of the Blockchain technology other than is the case in Palestine, and where have these countries reached?

- How does the judiciary handle dispute cases resulting from electronic financial transactions?