FACTORS DIRECTLY AFFECTING THE ADOPTION OF BLOCKCHAIN TECHNOLOGY IN DIFFERENT ORGANIZATIONS: META-ANALYSIS

BY

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ABSTRACT

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Title: Factors Directly Affecting the Adoption of Blockchain Technology in different

Organizations: A Meta-Analysis

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The meta-analysis process has been done on a sample of 27 studies and this analysis derived many solutions about firm size, perceived utility and relative advantage. The hype surrounding blockchain has drawn a lot of interest in the technology's potential to reshape industries and reengineer business processes. The study analysis of this article has been obtained through the systematic literature review process. Several factors have been identified as enablers or barriers to the integration of blockchain technology within companies. To validate and assess the effect of these factors on adoption, I conducted a meta-analysis of a wide range of research findings that employs the technology acceptance model as a theoretical background, investigating how performance expectancy, effort expectancy, social factors and facilitating conditions influence the willingness to embrace blockchain technology. Additionally, the effect of trust, firm size and cost in the intention to adopt this technology involved in this study. The results of this research demonstrate that among the articles analyzed, the primary determinants of the inclination to embrace blockchain technology are the size of the organization, the perceived benefits, and the comparative advantages. Among the factors examined previously, namely cost, government support, and complexity, none exhibited a substantial effect size capable of

influencing the inclination to adopt blockchain technology. The meta-analysis adds to the body of knowledge by providing a comprehension understanding of the elements that shape the adoption of blockchain technology, empowering businesses to make educated decisions about its implementation and formulate successful adoption and integration plans of the blockchain technology.

DEDICATION

I am dedicating this thesis to my lovely parents who always believe in my ability to reach wherever I want. Many thanks to my respectful and co-operative supervisor on this project Dr. Karma.

Special thanks to my three spiritual catalysts, my sister Ghida, and my best friends Reem and Hana. They deserve to have their names written here.

Thanks to my kids for being in my life and their patience on my negligence.

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CHAPTER 1: INTRODUCTION

1.1 Background

Blockchain is a decentralized database system that provides secure and transparent transactions without the need for intermediaries. It has the potential to revolutionize businesses: transforming organizational structures and modern management practices by enabling decentralized decision-making. The technology has been widely applied in supply chain management, healthcare, voting systems, and more (Habib et al., 2022).

The incorporation of blockchain technology into the business operations of organizations has piqued the interest of both the academic and corporate worlds (Clohessy et al., 2019). Numerous large corporations and institutions have publicly declared their investments in blockchain, whereas others are contemplating future investments (Scott et al., 2017). As the banking sector goes through its journey of digital transformation, blockchain technology is considered as a secure way of storing digital information in a public shared databases (Albeshr & Nobanee, 2020). Financial institutions are particularly interested in eliminating intermediaries and using the technology to provide a tamper-proof record of transactions, especially in cross-border payments (Wu & Duan, 2019).

The potential of blockchain technology to revolutionize supply chain management is substantial, as it provides a secure and transparent ledger of transactions. Walmart's implementation of blockchain to trace the source of food products demonstrated enhanced transparency and responsibility in the process. (Vu et al., 2021). Blockchain technology has emerged as a viable means of enhancing food traceability, safety, and transparency, raising customers' expectations towards the quality and safety standards required for food products (Acciarini et al., 2023).

As organizations strive to create more ethical work environments, blockchain technology is emerging as a key enabler (Maddikunta et al., 2022). Through the application of artificial intelligence (AI) algorithms, blockchain technology promises to improve organizational processes, increase transparency and accountability and foster a more ethical workplace. However, a thorough investigation of and examination of factors affecting adoption is essential in adopting the technology (Sharif, M., & Ghodoosi, F., 2022).

1.2 Types of Blockchain Technology

Three main categories of blockchain technology exist: private blockchain, public and hybrid. In essence, all these categories encompass a set of nodes operating in a peer-to-peer (P2P) network. Each node in the network maintains a copy of the shared ledger, which undergoes regular updates and validations whenever transactions are initiated or received. (Banerjee, 2023).

Paul et al. (2021), differentiated between private and public in that private blockchains are employed for private networking purposes, limiting access only to authorized users within a restricted network. Network administrators hold the authority to manage activities and individuals seeking permission, such as new nodes or users, must communicate with the system or network administrators (Ncube, N, 2020). Businesses and organizations frequently use private blockchains to improve data management, increase efficiency, and streamline operations inside their own ecosystems (Dinh et al., 2017). In order to promote safe and effective interbank transactions, for instance, a group of banks may use a private blockchain for quick settlement and elimination of the middlemen (Paul et al., 2021). This type of blockchain also called restricted and non-open, emphasizing access control. They prevent outside access to transactional data and information exchanged between nodes and allow transactions only with permission from the system administrator.

One of the advantages of private blockchain is speed, as they can handle transactions at a high rate due to the limited number of nodes involved. Private blockchains also exhibit better scalability, allowing for easy addition of nodes without significant impact on the existing system (Viriyasitavat & Hoonsopon, 2019). They are thus known for their privacy, high efficiency, faster transactions, better scalability, and speediness. They offer enhanced security, authorizations, permissions, and accessibility.

However, private blockchains have their drawbacks. Trust-building becomes essential since limited access requires establishing trust among the participants. Lower security is a concern when a third-party gains access to the central management system, facilitating the possibility for a single node to jeopardize the integrity of the entire private blockchain system. (Paul et al., 2021). As such, private blockchains are commonly deployed for voting, supply chain management and digital identity management.

A public blockchain refers to a digital ledger that is open to anyone interested in joining the network. It operates in a decentralized manner, ensuring transparency for all participants (Khan et al., 2019). Public blockchain is a distinguished variant of blockchain characterized by its openness and decentralization. On this network, anyone interested in conducting transactions has access. Public blockchain operates as a non-restrictive and distributed ledger system that does not require permission, granting access to data or specific parts of the blockchain to authorized individuals. It is extensively used for mining and exchanging cryptocurrencies like Bitcoin and Litecoin (Ferdous et al., 2021). While it offers high security, transparency, and an open environment, there are no strict regulations and policies to govern its operation.

Trust, security, and transparency are among the advantages of public blockchain. Data transparency and openness are inherent features, ensuring that transactions and information are available to authorized nodes. Participants on the network validate transactions and receive rewards using two models of validation: Proof-of-Work and Proof-of-Stake (Chepurnoy, 2017).

Public blockchains have their own limitations, such as lower per second transaction rates due to the large network size; and the need for verification through proof-of-work by each node. The proof-of-work consensus mechanism in public blockchain results in high energy consumption, which poses challenges in terms of energy, environmental, and financial aspects (Sedlmeir et al., 2020).

A third type of blockchain referred to as a hybrid blockchain technology (Haque & Rahman, 2020) is a combination of public and private blockchains, aiming to achieve higher objectives and better control (Alkhateeb et al., 2022). Hybrid blockchains encompass elements of both centralized and decentralized systems, creating a framework that is not openly accessible. Despite its restricted nature, it upholds qualities such as integrity, transparency, and security. By combining the advantages of a private system (need permission) and a public system (no permission needed), hybrid blockchains allow for extensive customization. Users can selectively access specific sections while the remaining data is securely stored or recorded in the ledger. Hybrid blockchains provide flexibility, allowing users to easily join as in a private blockchain when permissioned. By this meaning, security and transparency of the network will be enhanced.

1.3 Motivation of the Study

In order to remain competitive, companies need to explore and reinvest in new avenues for growth. Fernando et al. (2022) suggests that blockchain technology can offer significant benefits to businesses and governments interested in promoting economic growth. Although managers comprehend the necessity of refocusing on these major trends, implementing changes is not always quick or efficient. Companies encounter challenges when it comes to developing their technological capabilities. Introducing new technology into an industry can be a complex and time-consuming (Panghal et al., 2023). New technology poses numerous challenges for organizations, altering work processes and the nature of tasks individuals are required to undertake. Moreover, international competition, along with domestic rivalry, is exerting pressure on businesses (Woodside, 2017) to constantly be ready to adopt puzzling change (Walsh et al., 2021). Understanding the obstacles that companies and people encounter, as well as, identifying the elements that either impede or facilitate the adoption of blockchain, is critical. Through the identification of these enablers and barriers, companies are able to devise strategies and solutions to facilitate adoption and encourage sustainable usage of the technology (Chowdhury et al., 2022).

The literature has identified numerous factors that can impact the inclination to embrace this technology (Nath, Khayer, Majumder, and Barua 2021; Hastig, & Sodhi, 2020). Identifying the factors aids in clearing up misunderstandings, addressing issues, and emphasizing the advantages of blockchain technology to prospective users (Matlebjane et al., 2022). Collectively, the factors evaluated whether blockchain is capable of fulfilling its promises. Eight essential factors cover the assessment: reliability of systems, ease of use and training, timeliness of production, quality, authorization, compatibility, user relationships, and capability.

This research intends to examine the key factors that directly impact the acceptance of blockchain technology across various organizational contexts. The investigation draws upon a comprehensive meta-analysis encompassing 27 studies (all included studies cited in the appendix of this paper). A thorough and methodical examination of the current body of literature is necessary to acquire a more profound comprehension of the advantages and obstacles linked to the adoption of blockchain technology, despite the fact that many independent studies have investigated its significance.

1.4 Research Purpose

The objective of conducting this meta-analysis is to provide a comprehensive overview of the factors that impact the adoption of blockchain technology in organizational environments. This is achieved by consolidating and summarizing the findings from 27 individual studies. The primary purpose of this study is to enhance the existing body of literature by consolidating empirical data and offering significant perspectives on the assimilation procedure, determinants of decision-making, and execution tactics utilized by firms while incorporating blockchain technology. This meta-analysis aims to enhance comprehension of the determinants that facilitate or impede blockchain adoption. The following research questions should be answered by in this meta-analysis:

1. What are the primary obstacles that organizations face while adopting the blockchain technology?
2. What are the key considerations for organizations when adopting blockchain technology, including decision-making processes, implementation strategies, and stakeholder involvement?

By addressing the objective of this study, understanding of the benefits and challenges associated with implementing blockchain technology will be enhanced. In identifying the factors, we are able to devise strategies to facilitate the adoption phase and guide firms in their strategic decision-making and facilitate their effective implementation of blockchain technology without operational challenges. The findings of this study hold the possibility of providing guidance to policymakers and industry experts in establishing an environment that is favorable to the adoption of blockchain technology. This includes addressing obstacles and optimizing the advantages of this innovative technology.

1.5 Research Objective

The objective of this study is to examine the factors that directly influence the inclination to embrace blockchain technology across various organizations, utilizing the Unified Theory of Acceptance (UTAUT) model. The UTAUT model has been widely employed to assess the influence of various organizational and technological factors on adoption (Dwivedi et al., 2019). In this study, those factors are classified into four categories: performance expectancy, effort expectancy, social influence, and facilitating conditions. Additionally, the study will measure the influence of trust and cost on the intention to adopt blockchain technology, as these factors have been consistently mentioned in various articles.

To date, a sole meta-analysis (Neelesh. K, 2023) has been conducted with the purpose of examining the antecedents and outcomes of blockchain technology. The study employed the technology-organization-environment (TOE) framework to investigate the determinants of blockchain technology adoption and its associated outcomes. For a more comprehensive inclusion of factors, the UTAUT model was employed in our meta-analysis. Furthermore, it is noteworthy that the papers incorporated in Neelesh's meta-analysis were characterized by diverse objectives, including the identification of variables that affect the utilization of cryptocurrency, enhancing understanding of managers' hesitancy towards adopting blockchain technology and assessing the effects of blockchain technology on the competitive performance of diverse organizations. The study under consideration incorporated a limited number of 16 articles that primarily centered on the factors influencing the adoption of this technology. Consequently, our research aims to offer a more extensive analysis of those factors in various organizational contexts and for that the study encompasses articles that specifically investigate this aim only.

1.6 Structure of the Study

The structure of this paper is outlined as follows: the literature review section presents a thorough synopsis of the pertinent existing research and theories. Next, we outline our theoretical framework, which forms the basis of the hypotheses presented in the subsequent section. In addition, we describe the research methodology and its validity. Subsequently, we present and analyze the findings. The paper concludes with a final section that includes a discussion of this research

CHAPTER 2: LITERATURE REVIEW

2.1 Blockchain technology

A blockchain refers to a database that is decentralized across multiple computers and maintains a sequential list of records in the form of blocks. These blocks are interconnected through cryptographic techniques, where every block contains a cryptographic hash of the previous block, a timestamp, and transaction details. The blockchain is decentralized and available to the public, and once a block is added to the chain, it is impossible to be altered without modifying all the subsequent blocks. and obtaining the agreement of the network (Puthal et al., 2018) Cryptography makes the blockchain technology a trusted technology where the data cannot be manipulated or modified (Gururaj et al., 2020). Decentralization is another feature of blockchain which involves the delegation of control and decision-making from central authority, such as an individual, organization, or group, to a distributed network (Salah et al., 2019). The aim of a decentralized network is to minimize the level of trust that participants need to have in each other and prevent any one participant from exerting undue authority or control over others, which could disrupt the network's functionality. The decentralization of the blockchain makes it a distributed network called Distributed Ledger Technology (DLT). The ledger, which contains all the data to be managed, is stored and managed on the computers of participants who are connected to the peer-to-peer (P2P) network (Kim, 2020).

A decentralized and distributed network of computers, known as nodes, manages transactions in a blockchain. Beside decentralization and trust, blockchain has other features such as scalability, security and traceability. Figure 1 shows the difference in a centralized and decentralized network diagrammatically. Scalability refers to a network's capacity to handle a larger volume of transactions. Security is a crucial factor that ensures the ledger's immutability and resilience against cyber-attacks (Zheng et al., 2019). The implementation of blockchain technology is frequently motivated by the aim of augmenting security measures. However, it is crucial to recognize that this can potentially give rise to specific security obstacles. Despite being recognized for its decentralized and transparent characteristics, blockchain is not entirely impervious to security vulnerabilities. An area of concern in the realm of blockchain security is the susceptibility of individual participants within the network (Alketbi et al., 2018). The security of the entire blockchain system is contingent upon the security of each individual node belonging to the participants, given that blockchain functions on a distributed network (Li et al., 2017). The integrity of data and consensus within blockchain networks is maintained through the utilization of cryptographic algorithms and consensus mechanisms. Conducting routine security audits, implementing updates, and enhancing security measures are imperative in mitigating evolving security risks and ensuring the resilience and integrity of the blockchain infrastructure (Sadik et al., 2020). The scalability of blockchain networks assumes critical significance as they expand in magnitude and intricacy, necessitating the accommodation of a greater transactional load. The scalability of conventional blockchain networks, exemplified by Bitcoin and Ethereum, has been hindered by their consensus mechanisms and constrained transaction processing capabilities (Swan, 2021). Traceability feature of the blockchain makes it a useful technology to be used in supply chain management as it traces products from production upstream to distribution downstream. Based on Yiannas research, the expenses associated with product recalls can reach a staggering $93 billion, primarily due to difficulties in identifying the source of outbreaks. Blockchain technology is considered to enhance traceability efficiency and foster trust in food recall processes (Duan et al., 2020).

Due to key characteristics of blockchain and its convenient access to critical information enabling employees to oversee the internal operations of the company, many industries applied and benefited from blockchain technology such as finance and banking, health care, law enforcement and security industries, supply chains, identity management, media and governmental institutions (Panel, 2022). Despite the benefits of blockchain, many challenges render organizations as incapable of applying the technology. Vargas (2022), classified challenges to adopt blockchain technology in higher education institutions to technological, organizational and environmental challenges. Technological challenges summarized in immaturity, limited interoperability, complexity, usability, data privacy and security, lack of technological skills (Paththinige, 2021).

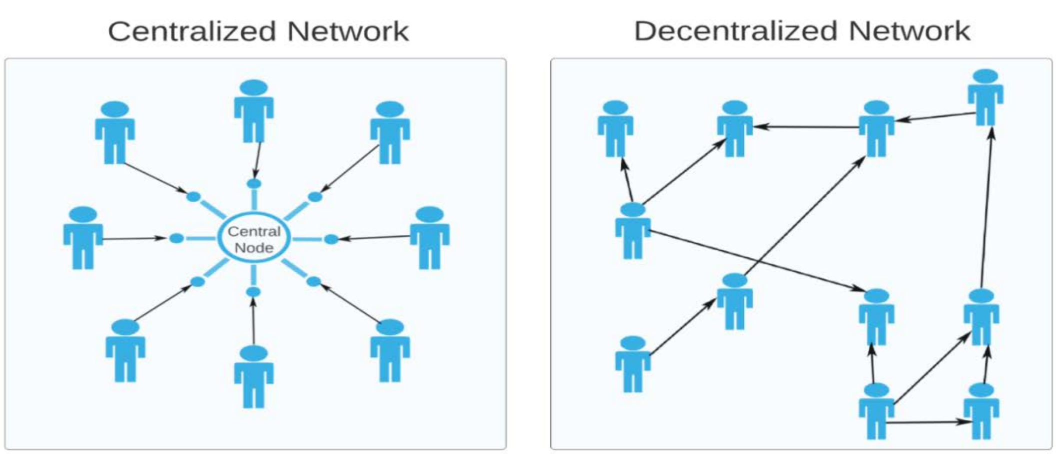

Figure 1: Centralized and decentralized network

2.1 Unified Theory of Acceptance (UTAUT) model

Given our focus on intentions to adopt blockchain, our study employs the unified theory of acceptance (UTAUT) model as the theoretical background for examining the effect of performance expectancy, effort expectancy and social influence on the intention to adopt blockchain technology (Francisco & Swanson, 2018). This model combined eight different historically developed models which cover most of the variables that influence the intention to adopt technology. Accordingly, outcomes obtained from this model can account for approximately 70% of technology acceptance behavior, however alternative models can only explain around 40% of the acceptance of technology across various fields (Salem, S.,2019). UTAUT is divided into four categories; performance expectancy refers to the degree to which an individual believes that using the system will help them enhance their job performance (Venkatesh et al., 2003). Performance expectancy contains perceived usefulness and relative advantage. Second, effort expectancy captures the level of simplicity in utilizing the system. This comprises perceived ease of use and complexity (Grover et al., 2019). Third is social factor, which is defined as the level to which an individual perceives that influential individuals or important figures in their life believe that he or she ought to utilize the new system. Social factor comprises subjective norms, social influence and competitive pressure (Eckhardt et al., 2009). Facilitating conditions is the fourth factor; pertains to the extent to which an individual believes that an organization possesses the necessary technical infrastructure to facilitate the implementation of the system. Compatibility, perceived behavioural control, top management support, government support, and organizational readiness make up the construct facilitating conditions (Chang et al., 2007; Yi et al., 2006; Gupta, Dasgupta & Gupta, 2008; Im, Hong & Kang, 2011; Al-Gahtani, Hubona & Wang, 2007). Given that blockchain adoption is an organizational level decision, we will not use UTAUT2 which is the suggested extension of the UTAUT model when addressing the behavioral and attitudinal factors that influence the usage of technology in a non-organizational setting (Venkatesh, Thong & Xu, 2012). However, trust, which is included in the UTAUT2, is considered as a factor which directly affects the intention to adopt blockchain technology (Casey & Wilson-Evered, 2012).

Figure 2 portrays the conceptual model of this meta-analysis:

2.1.1 Performance Expectancy

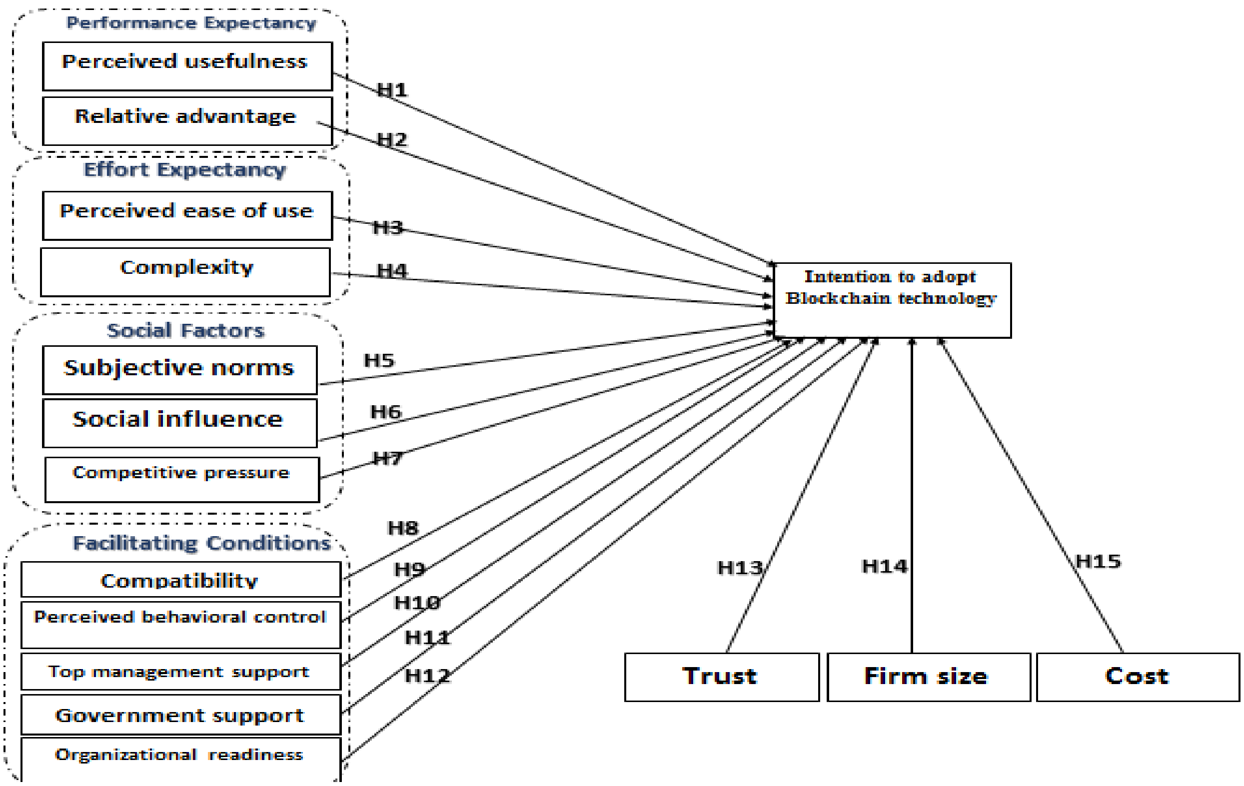

Figure 2: Conceptual model

In the context of adopting blockchain technology, the notion of performance expectancy pertains to the level of assurance and conviction among employees regarding the favorable outcomes that the implementation of blockchain technology will yield for their job performance and the overall operations of the organization (Jena, R. K., 2022). Performance expectancy can be also described as the extent to which the use of technology can provide benefits to consumers, particularly when engaging in specific activities (Yusof, H, 2018).

Within the context of professional settings, the scope of duties and obligations associated with job performance and operations is expansive. The utilization of blockchain technology has the potential to greatly enhance and optimize these activities. The decentralized and transparent characteristics of blockchain technology facilitate secure and efficient transfer and verification of digital assets and transactions, thereby eliminating the necessity for intermediaries and minimizing administrative complexities (Zhu, L., et al., 2021). According to Swan (2015), the implementation of this technology has the potential to improve the speed and precision of financial transactions, supply chain administration, and contract fulfillment, resulting in improved operational efficacy and reduced expenses.

Furthermore, the capacity of blockchain technology to generate unalterable and verifiable records of transactions and data has the potential to augment the reliability and authenticity of information within organizational settings (Yli-Huumo, J., et al., 2016). According to Beck et al. (2018), the implementation of this approach can yield favorable outcomes for data management, record-keeping, and compliance procedures by mitigating the likelihood of fraudulent activities, tampering, and unauthorized entry. Personnel can exhibit higher levels of trust in the precision and dependability of the information they utilize for decision-making and reporting.

The adoption of blockchain technology facilitates the automation and implementation of smart contracts, which are agreements that are self-executing and contain predetermined rules that are encoded on the blockchain. The implementation of automation technology has the potential to optimize and simplify the management of contracts, resulting in a decrease in the duration and resources expended during the stages of contract bargaining, implementation, and enforcement. According to Iansiti and Lakhani (2017), the utilization of technology reduces the likelihood of mistakes made by humans and guarantees the uniform and clear implementation of contractual provisions.

Through the utilization of these capabilities inherent in blockchain technology, organizations can optimize their performance and operations in diverse manners. The implementation of blockchain technology has the potential to enhance operational efficiency, bolster data integrity, foster trust, and optimize contract management procedures (Gad et al., 2022). The advantages of these benefits are not limited to enhancing individual performance, but also extend to augmenting the overall effectiveness and competitiveness of the organization. Therefore, acceptance of a new technology by employees is always be linked with the gained benefit from the technology and the level of this technology to enhance the job performance.

As per the UTAUT model used in this meta-analysis, performance expectancy contains perceived usefulness and relative advantages.

2.1.1.1 Perceived Usefulness

Perceived usefulness holds a prominent position in acceptance research when it comes to adopting specific information technologies. It pertains to the extent to which an individual believes that utilizing a particular technology will enhance their job performance. According to Turhan and Akman (2021), perceived usefulness plays a crucial role in the adoption of new technologies, as users are more inclined to embrace technologies they perceive as beneficial to their work. Similarly, Gao and Li (2021) The findings revealed that perceived usefulness exerted the greatest influence on users' intention to engage with blockchain-based games, suggesting that users are more inclined to adopt blockchain technology if they perceive it as beneficial for both work and leisure activities. Other studies, such as those conducted by Chowdhury (2022), Guan (2023), Alazab and Alhyari (2021), and Kamble (2019), have also identified perceived usefulness as a significant factor in the adoption of new technologies. Perceived usefulness is the common term used in most of the literature reviews to describe this factor. In our study we added “blockchain efficiency” mentioned in one study as part of the perceived usefulness construct definition. The paper defined blockchain efficiency as the efficiency related to the implementation of blockchain technology while utilizing existing resources. It involves achieving desirable outcomes and effectively meeting the requirements of stakeholders to their level of satisfaction (Alazab, 2021).

2.1.1.2 Relative Advantages

Relative advantage pertains to the comparative benefit or advantage associated with adopting a particular technology over existing alternatives or previous practices. The relative advantage can be influenced by factors such as cost savings, speed of transactions, and enhanced security (Lin, 2023). Relative advantage can also be defined as the perception that a new technology has advantages over existing technologies and provides better ideas than alternative technologies (Lin, H., 2023). The factor was found to be a significant driver of firms’ motivation and willingness to adopt blockchain technology in various industries, including maritime, Small and

Medium-Sized Enterprise (SMEs), and Readymade Garment (RMG) manufacturers and exporters (Wong, L., 2020). The relative advantage of blockchain technology led firms to adopt it as a carbon trading platform to effectively and efficiently procure energy (Fernando, Y. 2022). Relative advantage signifies the favorable disparity between the benefits an organization can attain and the efforts involved in adopting blockchain technology. This primarily focuses on intangible advantages such as enhanced reputation, increased customer satisfaction, and improved response speed. (Wong, L., 2020).

2.1.2 Effort Expectancy

Effort expectancy refers to the simplicity of use which is the degree of ease associated with employing a technology. The more user-friendly a technology system is, the higher the likelihood of users adopting it. Users are unlikely to embrace a technology that they perceive as challenging or complicated to use. Simplicity of use is closely tied to the efficiency of the technology. For example, data sharing protocols can facilitate the development of efficient and effective data recording systems, reducing reliance on traditional data tracking methods (Alazab, M., 2021). Previous studies have demonstrated a positive relationship between simplicity of use and the intention to adopt a technology (Mensah & Mwakapesa, 2022). Regarding blockchain technology, it was anticipated that the complexity associated with diverse activities would experience a notable decrease. As a result, this would facilitate enhanced efficiency throughout the supply chain operations (Nguyen & Luan, 2021).

According to UTAUT model, perceived ease of use and complexity are part of the effort expectancy.

2.1.2.1 Perceived ease of use

Perceived ease of use is a significant factor in acceptance research when it comes to adopting a specific information technology. Essentially, it signifies the amount of exertion needed to operate a system and the extent to which individuals believe that utilizing the system can improve their job performance. According to Turhan and Akman (2021), perceived ease of use serves as a notable predictor for the adoption of new technologies, as users are more inclined to adopt technologies that are user-friendly and demand less effort. Similarly, Chowdhury (2022) discovered that perceived ease of use emerged as another predictor for enhancing the adoption of blockchain-based games, as the perception of the technology's usefulness is positively influenced by the ease with which it can be used. Papers used "effort expectancy" term was added to this category. Effort expectancy holds significant importance within the context of perceived ease of use, as it represents the perception of individuals or organizations regarding the level of effort associated with using technology (Alazab & Alhyari, 2021). Surarityothin (2022) discovered that effort expectancy has an impact on the adoption of blockchain technology, particularly among users aged 45 and above, who may possess lower proficiency and willingness to use information technology compared to younger individuals.

2.1.2.2 Complexity

Complexity refers to the level of intricacy involved in comprehending and adopting a new technology. Perceived complexity refers to the degree to which an innovation is perceived as relatively difficult to comprehend and implement, consequently heightening effort expectancy and diminishing perceived ease of use (Lin, H., 2023).

Consequently, complexity can serve as a hurdle to adoption and successful implementation (Fernando, Y., 2022), especially for organizations with limited technical expertise. The complexity of this technology is influenced by factors such as the level of technical expertise within the organization and the degree to which the technology is standardized across different industries (Alazab, M., 2021).

2.1.3 Social factors

Social factors refer to the various societal and cultural elements that influence the adoption of the technology. These factors encompass the attitudes, beliefs, behaviors, and interactions of individuals, communities, and institutions within a society. Social factors can include aspects such as perception, knowledge, awareness, social acceptance, collaboration, cultural norms, and privacy concerns. They play a crucial role in shaping the adoption of blockchain technology by influencing the attitudes and decisions of individuals and organizations towards its implementation and use. In this study, we studies subjective norms, social influence and competitive pressure.

2.1.3.1 Subjective norms

Subjective norms represent another influential factor in the acceptance of technology. It encompasses the perceived social pressure to engage in a behavior based on an individual's normative beliefs and their motivation to comply with those beliefs. According to Kamble (2019), subjective norms reflect an individual's perception of whether significant others believe they should or should not adopt a particular behavior. In essence, subjective norms capture an individual's perception of the social pressure to adopt or refrain from adopting new technologies based on their beliefs about others' expectations. Prisco and Abdallah (2022) highlight that subjective norms are one of the factors that can influence employees' behaviors regarding the adoption of blockchain. Similarly, Gao and Li (2021) found that subjective norms emerge from normative beliefs associated with what a relevant individual expects in terms of technology adoption, as well as the individual's motivation to comply with those beliefs.

2.1.3.2 Social influence

Social influence refers to the impact that the beliefs and actions of peers, family and friends can have on an individual's behavior (Alazab et al., 2021). This influence can be divided into two categories: normative and informational. Normative social influence refers to the power to comply with the values of another (Nazim, N., 2021). This type of influence can arise from a desire to fit in with a group or to avoid disapproval from others (Surarityothin, P, 2022). Informational social influence, on the other hand, is related to the impact of collecting information from the experience of others. This type of influence can arise when an individual is uncertain about a situation and looks to others for guidance (Nazim, N., 2021).

Social influence is proven to affect organizational decisions to adopt a technology Talukder, M, 2011). It can play a positive role in encouraging the adoption of blockchain. As social influence increases, a more supportive environment for blockchain adoption is likely to exist (Alazab et al., 2021).

In the context of blockchain technology adoption, researchers have found that using group leaders to influence adoption can be an effective way to ensure the benefits of blockchain implementation (Surarityothin, P, 2022). This can lead to an increased intention to use the technology. (2021).

2.1.3.3 Competitive pressure

Competitive pressure represents the extent to which organizations within a particular industry or sector vie with one another for resources such as customers or market dominance. When organizations face intense competition, they may be more likely to adopt blockchain as a way to gain a competitive advantage. The competitive pressure can drive organizations to adopt blockchain to enhance their market position. Competitive pressure refers to the pressure that an enterprise feels when compared with competitors within its industry (Turhan, C., & Akman, I, 2021).

This pressure can drive firms to invest heavily in technology in order to stand above their rivals (Fernando, Y., 2022). Competitive pressure can also arise from internal factors such as the aspiration to attain a competitive edge by adopting innovative technologies (Wong, L., 2020). Firms may also face by influence exerted by participants both upstream and downstream in the supply chain, along with the impact of emerging business models and industry standards (Hashimy, L., (2022). Also, this pressure can come from both direct and indirect competitors and can influence a firm’s decision to adopt new technologies. Firms that operate in highly competitive industries may feel more pressure to adopt new technologies than firms in less competitive industries. When firms perceive that their competitors are adopting new technologies, they may feel pressured to do the same in order to keep up (Fernando, Y, 2022).

In addition, the environment may act as one of the competitive pressures on the organization exerting influence towards the adoption of blockchain technology. The environment takes into account factors such as industry, competitors, macroeconomic factors, and government regulations (Nazim, N., 2021). It is expected that the environment is likely to influence the behavioral intention to adopt blockchain technology (Nazim, N., 2021).

2.1.4 Facilitating conditions

Facilitating conditions refer to the presence of institutional support and infrastructure aid in the utilization of a specific technology (Jena, R. K., 2022). Previous research has demonstrated a positive impact of facilitating conditions on the adoption of digital technologies in supply chains. The presence of technical resources and organizational support has been shown to positively influence the adoption of the technology in supply chains (Francisco and Swanson, 2018).

Five factors included under facilitating conditions are considered relevant for the adoption of blockchain technology: compatibility, perceived behavioral control, top management support, governmental support and organizational readiness.

2.1.4.1 Compatibility

Compatibility pertains to the degree to which an innovation is perceived as harmonious with existing systems and processes, as well as its alignment with the values and objectives of the organization. Compatibility with existing systems and processes is an important consideration when adopting a new technology (Nath, S. D). Blockchain technology should be compatible with existing technologies and processes for successful adoption (Li et al., 2022).

Task technology fit evaluates the degree to which the technology supports the tasks it is intended to perform. When there is a good fit between the technology and the task it is intended to support, adoption is more likely to occur. A good task technology fit can also improve user satisfaction and performance (Alazab, M., 2021).

2.1.4.2 Perceived behavioral control

Perceived behavioral control represents another significant factor in the literature on technology acceptance. It refers to the individual or organizational perception of the ease or difficulty associated with engaging in a specific behavior, reflecting their ability to adopt such behavior (Lee et al., 2015). According to Prisco and Abdallah (2022), perceived behavioral control is influenced by past experiences as well as anticipated obstacles and barriers. Guan (2023) discovered that perceived behavioral control relates to individuals' understanding of their own capability to carry out a particular action, serving as a reliable indicator of their behavioral intention. Essentially, perceived behavioral control is an individual's perception of their own competency to execute a behavior and can significantly influence their decision to adopt new technologies (Guan, 2023).

2.1.4.3 Top management support

This factor has been identified as one of the main factors that can increase the likelihood of successful implementation and integration of blockchain into existing organizational processes and systems. When top management is supportive of blockchain adoption, it can increase the likelihood of successful implementation and integration of blockchain into existing organizational processes and systems (Agi & Jha, 2022)

Papers included in the meta-analysis defined top management support refers to the level of involvement and backing provided by top executives in the adoption of new technologies (Turhan, C, 2021). The support is primarily demonstrated through the allocation of resources and responsibility during the implementation process to facilitate blockchain adoption (Alazab, M, 2021). Wong, L stated that for cost improvements to be realized, strong support from upper management is essential and can be bolstered by the relative advantage of the technology (Wong, L, 2020). The involvement of top management holds a crucial position in the adoption of emerging technologies, given their substantial impact on significant decisions encompassing daily operations and potential investments (Nath, 2022). They are the key decision-makers who determine whether or not an innovation will be adopted (Hashimy, L, 2022).

2.1.4.4 Governmental support

Government support refers to the assistance provided by the government to boost the adoption of new technologies by enterprises (Lu, L, 2021). This support can come in the form of policies and laws that promote the adoption of innovations such as blockchain technologies. Regulatory support is another term used in the literatures which refer to the governmental support. Regulatory support plays an important role in monitoring and regulating the adoption of information technology innovation by industries or firms (Prisco, A, 2022). Government support can play a significant role in encouraging the adoption of blockchain, particularly in highly regulated industries such as finance and healthcare (OECD, 2020). Government support can provide the necessary regulatory framework and incentives to encourage organizations to adopt blockchain technology. When regulatory support is ample, adoption tends to be quick. However, studies have shown that regulatory support has insignificant influence on blockchain adoption (Nath, S, 2022).

2.1.4.5 Organizational readiness

Organizational readiness is the general term used to refer to organizational work climate, organizational readiness, organization characteristics, information sharing and collaboration culture and facilitating conditions. When comparing the definitions of these terms, organizational readiness can be understood as the organization's capacity to effectively manage various resources, including the sentiments, beliefs, and values of its employees, as well as financial and technical resources, in order to facilitate the adoption of blockchain technology. The organizational readiness, including factors such as organizational culture and employee attitudes towards innovation which can impact the willingness of organizations to adopt new technologies such as blockchain, termed as organizational work climate in the literature (Wang et al., 2022). Positive organizational work climate can lead to a supportive environment for blockchain adoption.

The factor of organizational readiness gauges the degree to which organizations possess common practices, shared beliefs, and value systems. (Turhan, C., 2021). This factor can influence the availability of resources required for the adoption of new technologies (Lu, L, 2021). Two of the included papers used the term of "organizational readiness" which defined as the degree of financial and technical resources available to support the adoption of new technologies and influence an organization’s adoption behaviors (Lin, H., 2023). Organization characteristics, environmental variable, information sharing and collaboration culture and facilitating conditions are all terms classified under organizational readiness in this meta-analysis.

Studies have shown that organizational characteristics have a statistically significant effect on organizations' adoption behaviors towards blockchain technology (Mulaji, S. S. M., & Roodt, S, 2022).

"Information sharing and collaboration culture" represents the capacity of an organization to empower stakeholders in accessing information and collaborating with supply chain partners to cultivate enduring relationships using blockchain technology. This culture can facilitate the exchange of information and collaboration among stakeholders (Nath, S. D., 2022).

2.1.5 Trust

Trust is another factor which holds significant importance in the literature on technology acceptance. It pertains to the psychological state that leads individuals to accept vulnerability based on positive expectations of the actions taken by the party they trust. As Nath (2022) suggests, trust is a critical factor in the adoption of new technologies, as users are more inclined to adopt technologies if they have trust in the technology itself and the entities involved. Likewise, Gao and Li (2021) discovered that trust played a vital role in the adoption of digital currency, particularly due to users' unique trust patterns in blockchain-based applications where there is no intermediary or central authority. Liu and Ye (2021) found that trust impacts the perception of user experience and subsequently influences user behavior. Additionally, Chittipaka (2022) found a strong association between trust and the adoption of blockchain technology.

2.1.6 Firm Size

Imagine two companies, one small and one large, both considering the adoption of new and advanced technologies. According to prior studies, the size of a firm is a crucial factor in the adoption of innovations, as larger firms exhibit a greater interest in embracing these technologies due to their enhanced capacity for risk management and potential returns. This enables them to adapt to risks more effectively compared to smaller firms (Pan & Jang, 2008; Zhu et al., 2011). In fact, firm size has been identified as a latent variable for the adoption of innovations (Alshamaila et al., 2013; Low et al., 2011; Makena & Kenyatta, 2013; Oliveira & Martins, n.d.; Tornatzky & Klein, 1982).

Bigger organizations, indicated by their employee count and capital, possess ample resources to facilitate energy efficiency initiatives. However, in this particular study, the perceived relative advantage did not influence the adoption of blockchain technology for carbon trading and energy efficiency. This might be attributed to the industry's limited recognition of the superior and appealing qualities of blockchain technology as a platform for carbon trading and energy efficiency. Additionally, the presence of higher technological complexity served as a deterrent for firms to adopt blockchain technology (Fernando et al., 2021).

As stated by Li et al. (2022), the size of a firm plays a critical role in the adoption of blockchain technology within the construction industry. Larger firms are deemed to be more capable of controlling and influencing the innovation process positively. This advantage stems from their greater resources and capabilities, which enable them to navigate the transition from old systems to new ones more effectively. Numerous studies have further supported the notion that firm size has a positive impact on and control over the innovation process, underscoring its significance for organizations considering the adoption of blockchain technology in the construction industry.

2.1.7 Cost

The cost factor holds substantial importance in acceptance research regarding the adoption of specific information technology. It pertains to the financial resources required for implementing and maintaining a technology. Wong (2020) highlights that the implementation of complex technologies typically entails higher costs. Paththinige (2022) identifies the cost of implementation and maintenance as one of the influencing factors in the adoption of blockchain technology within the pharmaceutical supply chain. Li and Zhang (2022) noted that the adoption of technology incurs various costs, and these costs influence the readiness to embrace the technology. Bhardwaj (2021) reveals that cost concerns significantly negatively affect the intention of small and medium-sized enterprises (SMEs) to adopt blockchain technology in supply chains. In essence, the cost of implementing and maintaining new technologies can pose a substantial barrier to adoption, particularly for smaller organizations with limited financial resources.

Factor Name	Definition	Alias	References
Top Management Support	The degree of support provided by senior executives and managers for the adoption of new technologies.	Management support, upper management support, Top management considerations	Agi, A., & Jha, S. (2022)
Governmental Support	The level of support provided by government agencies and regulatory bodies for the use of blockchain technology.	Regulatory support	OECD. (2020)
Organizational Readiness	The organization's ability to successfully adopt and integrate new technologies.	Organizational work climate, organization characteristics, information sharing and collaboration culture	Turhan, C., & Akman, I. (2021)
Trust	The psychological state leading to accepting the vulnerability of a trustor based on positive expectations of the trustee's actions.	-	Nath, S. D. (2022)
Firm Size	The size of the organization, measured by factors such as the number of employees and capital, that may impact the adoption and integration of new technologies.	-	Li, X., Liang, X., & Zheng, X. (2022)
Cost	The financial resources required for the implementation and maintenance of a technology that may impact the adoption and integration of new technologies.	Cost concerns	Wong, L. (2020)
Perceived usefulness	The degree to which an individual believes that using a new technology will improve their job performance or make their work easier.	Performance Expectancy, Blockchain efficiency	Vivaldini, M(2021)
Perceived ease of use	The degree to which an individual believes that using a new technology will be easy to use and understand.	Effort expectancy, perceived ease of use	Vivaldini, M(2021)
Social Influence	The impact that the beliefs and actions of peers, family, and friends can have on an individual's behavior. This can be divided into normative and informational social influence.	Social influence, Corporate Social Responsibility	Alazab et al. (2021)

Facilitating Conditions	The belief that the presence of institutional support and infrastructure can aid in the utilization of a specific technology.	facilitating conditions	Jena, R. K. (2022)
Subjective Norms	The perceived social pressure to perform or not to perform a behavior based on the person's normative beliefs and motivation to comply with those beliefs.	-	Prisco, G., & Abdallah, A. B. (2022)
Competitive Pressure	The degree to which organizations in a specific industry or field compete with one another for resources such as consumers or market share.	Environmental Variable (EV)	Wong, L. (2020)
Compatibility	The extent to which an innovation is viewed as compatible with the end-user's current beliefs, expectations, and requirements.	Perceived compatibility, Task technology fit	Paththinige, P. (2022)
Perceived Behavioral Control	The perceived ease or difficulty of performing the behavior and reflects an individual or organization's ability to adopt a certain behavior.	-	Lee, Y.(2015)

Table 1: Definition of constructs used in the meta-analysis

3.1 Technology Acceptance Theories Applied to Blockchain Adoption

Considering the significant investment in blockchain technology, it becomes crucial to assess the rate of adoption for new technologies and identify the factors that influence adoption and users' acceptance (Alazab et al., 2021). Gaining an understanding of the reasons behind users' acceptance or rejection of a technology can provide valuable insights to decision-makers during the development process. The utilization of adoption or acceptance models enables researchers to evaluate and predict users' responses to technology in various domains, including education, supply chain, voting, transportation, computer usage, and blood donation (Taherdoost, 2022). Numerous frameworks have been developed to illustrate the factors that impact users' adoption, and the subsequent sections will discuss the most common models.

A study conducted by Lou discussed two previously published theories of new technology acceptance. One is the Technology Acceptance Model (TAM) and the other is the Innovation Diffusion Theory (IDT). TAM is a significant and extensively applied theory in predicting and explaining technology usage by end-users. Taherdoost, (2022) systematic review of 56 articles summarized the commonly used adoption frameworks in evaluating the implementation of blockchain technology. The paper classified blockchain adoption models into eight models. However, the most commonly used theories, rest of the theories were the base to form those new theories, applied to understand the factors influencing the adoption of blockchain technology are the following:

3.1.1 Technology Acceptance Model (TAM):

TAM, introduced by Davis as an adaptation of the Theory of Reasoned Action (TRA) by Ajzen and Fishbein, is a model used to predict technology acceptance and usage (Lou, 2017). As mentioned earlier, TAM is one of the most widely employed adoption models and encompasses perceived ease of use and perceived usefulness as its primary factors. TAM addresses the limitations of psychometric and theoretical rigor in the TRA model by eliminating subjective norms (ALAKLABI & KANG, 2021). While the attitude toward technology usage is a significant factor in the TAM model, the impact of two crucial beliefs, namely perceived ease of use and perceived usefulness, shapes users' attitudes. These beliefs are examined as the system's favorability (Lou, 2017). TAM is a well-established theory that investigates user acceptance of technology. It posits that perceived usefulness, which refers to the extent to which individuals believe that utilizing the technology will enhance their performance, and perceived ease of use, which pertains to the degree to which individuals believe that using the technology will be effortless, are critical factors influencing technology adoption. Applied to the adoption of blockchain, TAM suggests that if users perceive blockchain as useful and easy to use, they are more inclined to adopt it (Marikyan & Papagiannidis, 2023).

3.1.2 Innovation Diffusion Theory (IDT)

Innovation Diffusion Theory (IDT), which is a well-known theory about technical innovation, has been widely applied in various fields. It argues that potential users make decisions to adopt or reject an innovation based on beliefs that they form about the innovation. IDT includes five significant innovation characteristics: compatibility, relative advantage, complexity, trialability, and observability. These characteristics are used to explain end-used adoption of new technologies and the decision-making process. However, according to a meta-analysis conducted by Tomatzky and Kein, only relative advantage, compatibility, and complexity were consistently related to the adoption of technical innovations. A combined model incorporating both TAM and IDT theories was suggested by the same study. The new suggested model examines how those factors influence the adoption of blockchain technology in the finTech industry by business managers. This new model suggested that perceived usefulness, perceived ease of use (TAM model), relative advantage, compatibility and complexity (IDT model) will affect the adoption of blockchain technology (Lou, 2017).

3.1.3 Unified Theory of Acceptance and Use of Technology (UTAUT)

The framework developed by Venkatesh et al. (2003) integrates eight different models, including TRA, TPB, TAM, DOI, extended TAM, motivational model, social cognitive theory, and the model of public-key cryptography utilization. By comparing and contrasting these frameworks, Venkatesh et al. (2003) identified four additional constructs: facilitating conditions, social influences, efforts, and performance expectancies. Furthermore, this model considers age, gender, voluntariness of use, and experience as moderating variables.

Awareness of the factors influencing the adoption of blockchain technology enables organizations and policymakers to allocate resources effectively (Liu & Lu, 2021). They can support projects that address identified challenges or provide assistance in areas that accelerate adoption. By thoughtfully allocating resources, the effectiveness of initiatives aimed at promoting blockchain adoption can be maximized.

3.1.4 Technology–Organization–Environment (TOE)

The TOE model provides comprehensive coverage of the entire technological innovation process, from its creation by entrepreneurs or engineers to its adoption by users (Clohessy & Acton, 2019). However, the TOE model specifically emphasizes the impact of the firm's context on the implementation and acceptance of the innovation. It highlights three primary contexts - technological, environmental, and organizational - to elucidate how various components within the firm influence the decision-making process of organizational adoption.

3.1 Conceptual Model and Hypothesis Formulation

The present study conducts a thorough meta-analysis to investigate the primary determinants that have a direct impact on the implementation of blockchain technology across diverse organizational settings. The objective of this meta-analysis is to offer a comprehensive account of the principal determinants that affect the adoption of blockchain technology by synthesizing and analyzing a relevant collection of research studies. Based on extracted constructs, hypotheses are formulated for the study.

As mentioned above, according to the UTAUT model, factors directly influencing the adoption of block chain technology in organizations are divided into four categories: performance expectancy, effort expectancy, social influence, and facilitating conditions. Trust, firm size, and cost are additional factors repeatedly mentioned in the literature and thus included in this meta-analysis. Figure 2 shows the conceptual model of this study on the factors directly affecting the adoption of blockchain technology in the intention to adopt blockchain technology. Table 2 summarizing the hypothesis of this study.

Hypothesis #	Hypothesis
H1	Perceived usefulness positively influences the intention to adopt blockchain technology
H2	Relative advantage positively influences the intention to adopt blockchain technology.
H3	Perceived ease of use positively influences the intention to adopt blockchain technology.
H4	Complexity positively influences the intention to adopt blockchain technology.
H5	Subjective norms positively influence the intention to adopt blockchain technology.
H6	Social influence positively influences the intention to adopt blockchain technology.
H7	Competitive pressure positively influences the intention to adopt blockchain technology.
H8	Compatibility positively influences the intention to adopt blockchain technology.
H9	Perceived behavioral control positively influences the intention to adopt blockchain technology.
H10	Top management support positively influences the intention to adopt blockchain technology.
H11	Governmental support positively influences the intention to adopt blockchain technology.
H12	Organizational readiness positively influences the intention to adopt blockchain technology.
H13	Trust positively influences the intention to adopt blockchain technology
H14	Firm size positively influences the intention to adopt blockchain technology
H15	Cost positively influences the intention to adopt blockchain technology

Table 2: Hypothesis

Chapter 4: METHODOLOGY

4.1 Selecting Studies

Multiple searches from different databases were conducted in Scopus, IEEE, Springer, Tayler and Frances, Emerald, and ProQuest. Only articles that have been published in English-language from 2019 are considered. The main keywords used for the search were "blockchain," "blockchain technology," "blockchain technology adoption," "adoption factors of blockchain," and "barriers to adopt blockchain. The detailed steps of selecting the articles are illustrated in Figure 3. The search from the different databases yielded a total of 595 articles. To determine the suitability of studies for meta-analysis, a hierarchical screening process was employed. Journals spanning the period from 2019 to 2023 were taken into account when considering articles for potential inclusion in the analysis. To maintain the rigor and data quality of this research, only peer-reviewed articles as a document type were chosen for inclusion. In addition, 115 duplicated studies were removed from our analysis, and 204 papers were excluded using automation tools (date of publication (2019-2023), full text online, journal articles, and English language). Subsequently, the remaining 276 articles were carefully reviewed manually to determine their suitability for inclusion in the meta-analysis. We excluded 225 articles when reading the title and abstract and 7 articles were excluded because the aim of their study was not relevant to our main aim (Ex. Studies focusing on the application blockchain in Cryprocurrancy). The remaining 44 articles were further filtered and 17 articles were excluded for because the lacked numerical data, where systematic reviews, or were not published. At the end, 27 articles were included in our study. All twenty seven studies employed a survey-based questionnaire for data collection.

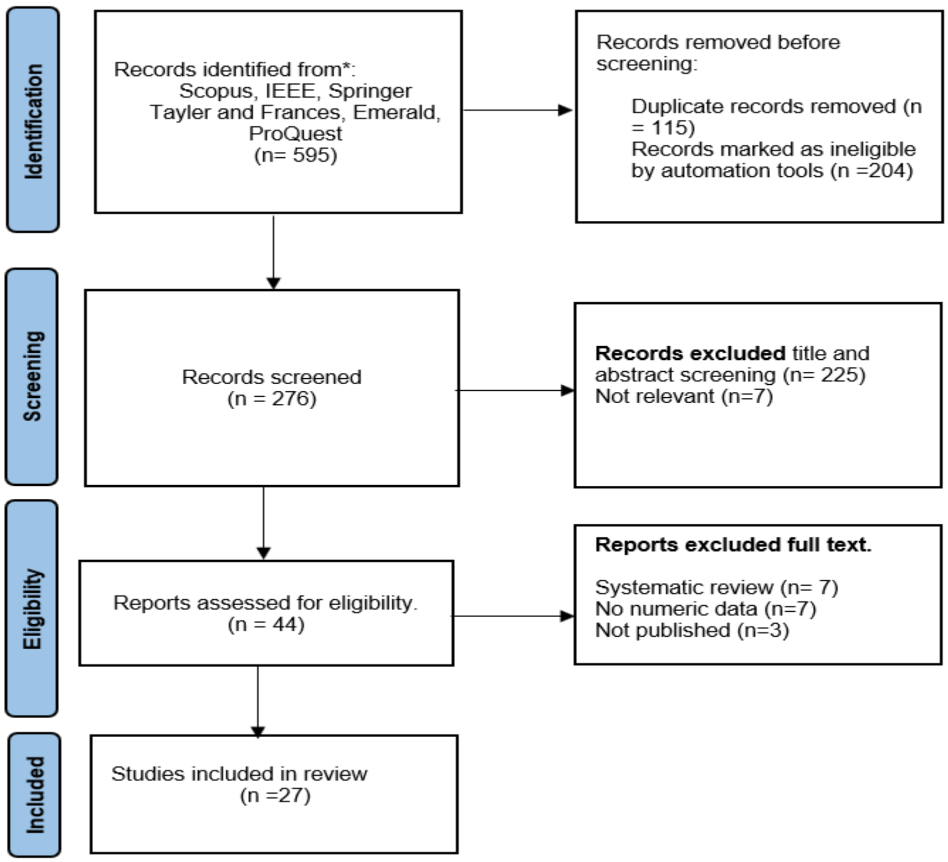

Table 3: Flow chart

4.2 Data Collection and Coding

Studies included in the meta-analysis examined factors affecting adoption of blockchain in different sectors like IT, construction, supply chain, sustainability, and banks and in different countries such as Australia, China, Malaysia, Thailand, Sri Lanka, Taiwan, and Korea.

while all studies collected data through a survey, the majority used the Least Square Regression method for analysis (PLS-SEM). Perceived usefulness, relative advantage, perceived ease of use, complexity, subjective norms, social influence, competitive pressure, compatibility, perceived behavioral control, top management support, governmental support, organizational readiness, trust, firm size, and cost were the most used variables in papers that study adoption of blockchain technology.

An excel data collection sheet was formed and all relative descriptive and numeric data was collected. Coding of the articles started with descriptive data such as sample size, field of the study, test used, location of the study and the factors affecting the adoption of blockchain technology. Second, we coded data regarding hypotheses related to the theoretical framework. For the relationships between intentions to adopt and the variables affecting adoption. The P-value, t-value, mean, standard deviation (SD), and the beta coefficient of all the factors were collected.

In order to ensure comprehensive coverage of the essential aspects and distinctions among all the chosen studies, we developed a summary to outlines characteristics of each study under review. This summary helped in identifying consistency and variability across studies. Consequently, each study was assigned a code to facilitate referral. The filtered articles were carefully reviewed again to identify those that utilized specific variables that will affect the adoption of blockchain technology. Correlation coefficients were primarily used as the measure of effect size for this meta-analysis which was not reported in the included studies. For instance, all included studies reported standardized beta coefficients, which were converted using the formula suggested by Peterson and Brown which is discussed in the following section.

4.3 Meta-analysis procedure

In this study, a meta-analysis was conducted for two primary purposes. Firstly, it is the first meta-analysis to have a comprehensive assessment of the correlation between different factors reported in different studies and the adoption of blockchain technology. Secondly, to achieve broader generalizations by encompassing significant studies and providing a more comprehensive understanding than what can be obtained from an individual primary study.

During the meta-analysis, the results of each study were collected as effect sizes, which are statistical measures representing the quantitative information for each relationship examined. These quantitative findings can manifest in various ways, including variations between group averages, correlations, and regression coefficients. The analysis phase of the study utilized correlations or regression coefficients (β) extracted from the papers included in the analysis. The effect size of the regression's coefficient r was calculated using the equation suggested by Peterson and Brown (2005):

$$r = \beta + 0.05\lambda$$

Where r is the effect size, β is the regression coefficient, λ is an indicator variable which is equal to one when β is not-negative and equal to zero when β is negative.

The rest of the analysis was done using Stata software. All the data extracted from the studies were uploaded into StataSE software. The results of the calculations were presented based on both random and fixed effect models. To ensure the reliability of the meta-analysis model, a heterogeneity test was conducted. The Q and I^2 statistics were evaluated to determine the presence of heterogeneity and to determine the appropriate use of a random-effects statistical framework and I^2 statistic evaluates the actual level of heterogeneity, indicating the proportion of total effect size variability attributable to true heterogeneity.

CHAPTER 5: RESULTS

The analysis in this study was based on 110 effect sizes which were the findings obtained through the systematic literature review process (Table 3, summarizing all the results of this study). Descriptive analysis and a meta-analysis were conducted for each correlation effect between two variables. Total number of sample sizes of the papers included in this analysis equal to 6263 which ranged from 56 to 650. Each hypothesis was supported by a varying number of studies, ranging from 3 to 11 studies (Summarized in Table 4). Among the included studies, the relationship between three factors; perceived usefulness, perceived ease of use and top management support, and intention to adopt blockchain technology have the largest aggregated sample size (K = 11; with total N = 2350, 1759 and 2442 respectively). On the other hand, subjective norms and firm size were less frequently studied in the included studies, with a smaller number of studies (K = 3) and a smallest total sample size of 641 and 892 respectively.

To decide whether to use the fixed or the random effect size results, we referred to the meta-analysis conducted by Yu (2022) for heterogeneity assessment. The approach suggested using the Fixed-effect model when I^2 is less than 50% and the random-effect model when I^2 is more than 50%. Based on this approach, we will analyze the random effect for all the factors (has $I^2 > 50\%$) except for subjective norms where I^2 is less than 50%.

Upon examining the 95% confidence interval for each effect size (r), it was observed that 12 out of 15 relationships between different factors and intention to adopt blockchain technology were supported. The three factors rejected were complexity, government support, and cost (p-value of 0.108, 0.284, and 0.279 respectively). The factor which had the largest relationship with the intention to adopt blockchain technology was firm size (H14, effect size of 0.39, p-value= 0.001). This was followed by perceived usefulness (H1, effect size= 0.333, p-value= 0.002) and relative advantage (H2, effect size= 0.303, p-value = 0.05). The smallest effect sizes were found for the relationships between subjective norms and the intention to adopt blockchain technology (H5, effect size= 0.164, p-value= 0.001). All other factors have significant relationship in the intention to adopt blockchain technology.

Evaluating the consistency of effects across studies is a crucial aspect of meta-analysis. Without understanding the consistency of study results, it is challenging to determine the generalizability of the findings obtained from the meta-analysis. In fact, various hierarchical systems for assessing evidence emphasize the importance of consistency or homogeneity among studies to achieve the highest level of grading (Jami Pour, M, 2021).

To evaluate the heterogeneity among different hypotheses, Q and I^2 are used. The Q estimates for all the factors were significant except for the subjective norms, indicating a rejection of homogeneity for all the studied factors except in the case of subjective norms. The Q estimates cannot measure the quantity of the heterogeneity and also is not conclusive when the factor has a low number of studies (the case of subjective norms case). Different methods can quantify the impact of heterogeneity by offering a measure of the extent of inconsistency in the results of the studies. This measure, which is I^2, provides an alternative approach to assess the degree of heterogeneity. I^2 Describing the percentage of overall variation across studies that is attributed to heterogeneity rather than chance. $I^2$is a number between 0% to 100%, the higher the number, the higher the heterogeneity. The elevated I^2 values in this meta-analysis indicate that a significant portion of the variability observed among studies is attributable to heterogeneity rather than random chance (Pour et al., 2021).

Fail-Safe N statistic used by researchers to determine the potential publication bias. In general, Fail-Safe N statistics should be at least twice the number of studies included in the meta-analysis (K). In this study, fail-safe N statistic numbers are very big, and all the tested hypotheses had a fail-Safe N to K ratio greater than 2, indicating that publication bias did not significantly impact the results (Higgins et al., 2003).

Cohen (1988) provided a way to categorize the strength of effect size into three levels: high ($r \geq 0.5$), medium ($0.3 \leq r < 0.5$), and low ($0.10 \leq r < 0.3$). Table 3 summarizes the strength of effect size for each correlation relationship between the factor and the intention to adopt blockchain technology. Three out of the 15 relationships were medium sized (Perceived usefulness, relative advantage and firm size). Those factors have the strongest relationship. Other twelve factors show small strength of the effect size which shows a small relationship between those factors and the intention to adopt the technology.

H#	Factor name	K	∑n	Effect size (r)	P-value	95% CI	I^2	Q	df	p-value of Q	Strength of the effect size	Fail-Safe N	Decision
H1	Perceived usefulness	11	2350	0.333	0.002	0.119,0.547	97.30%	364.12	10	0	Medium	26484.639	Supported
H2	Relative advantage	10	2705	0.303	0.05	0.233, 0.373	71.70%	31.75	9	0	Medium	18834	Supported
H3	Perceived ease of use	11	1759	0.206	0.000	0.206, 0.449	90.30%	103.44	10	0	Low	26484.639	Supported
H4	Complexity	8	1528	-0.073	0.108	-0.161, 0.016	67.90%	21.8	7	0.003	Low	682499	Non- supported
H5	Subjective norms	3	641	0.164	0.001	0.087, 0.24	0.00%	1.47	2	0.48	Low	39489	Supported
H6	Social influence	6	1335	0.275	0.022	0.039, 0.511	95.20%	104.96	5	0	Low	60893.715	Supported
H7	Competitive pressure	6	1163	0.239	0.009	0.061, 0.418	90.50%	52.8	5	0	Low	42295.113	Supported
H8	Compatibility	10	2974	0.292	0.05	0.203, 0.38	83.50%	54.49	9	0	Low	25139	Supported
H9	Perceived behavioral control	4	973	0.256	0.01	0.072, 0.441	85.90%	14.16	2	0.001	Low	30501	Supported
H10	Top management support	11	2442	0.264	0.001	0.199, 0.329	62.40%	26.59	10	0.003	Low	30273	Supported
H11	Government support	10	2601	0.079	0.284	-0.065, 0.223	92.80%	124.8	9	0	Low	1507188	Non- supported
H12	Organizational readiness	7	2338	0.257	0.001	0.141, 0.373	88.20%	84.88	10	0	Low	8569	Supported
H13	Trust	6	2140	0.228	0.001	0.161, 0.296	59.50%	12.35	5	0.03	Low	44184	Supported
H14	Firm size	3	892	0.39	0.001	0.23, 0.549	82.60%	11.48	2	0.003	Medium	10471	Supported
H15	Cost	4	710	0.137	0.279	-0.111, 0.386	91.00%	33.23	3	0	Low	14647	Non-supported

Table 4: Summary table of results

Factor Name	Number of studies	Study	Total number of sample size (∑n)
Perceived Usefulness	11	Alazab, M., Alhyari, (2021), Bhardwaj, A. (2021), Chowdhury, S., (2022), Gao, S., & Li, Y. (2021), Kamble, S. S., (2019), Liu, N., & Ye, Z. (2021), Nazim, N. (2021), Prisco, A., Abdallah, (2022), Surarityothin, P.,(2022) Turhan, C., & Akman, I. (2021), Wang, X., (2022)	2350
Relative Advantage	10	Bhardwaj, A. (2021), Chittipaka, V., (2022), Fernando, Y., (2022), Hashimy, L., Jain. (2022), Li, C., Zhang, (2022), Lin, H. (2023), Lu, L. (2021), Nath, S. D., (2022), Ullah, N (2021), Wong, L., (2020)	2705
Perceived Ease of Use	11	Afifa, M. A., (2022), Alazab, M., Alhyari, (2021), Bhardwaj, A. (2021), Chowdhury, S., (2022), Queiroz, M. M., Wamba, S. FNath, S. D., (2022), Gao, S., & Li, Y. (2021), Liu, N., & Ye, Z. (2021), Nazim, N. J. N. B., (2021), Surarityothin, P., (2022), Turhan, C., & Akman, I. (2021), Wang, X., (2022)	1759
Complexity	8	Bhardwaj, A. (2021), Fernando, Y., (2022), Hashimy, L., Jain. (2022), Li, C., Zhang, (2022), Lin, H. (2023), Lu, L. (2021), Malik, S., (2021), Wong, L., (2020)	1528
Subjective Norms	3	Gao, S., & Li, Y. (2021), Kamble, S. S., (2019), Prisco, A., Abdallah, (2022)	641
Social influence	8	Afifa, M. A., (2022), Alazab, M., Alhyari, (2021), Queiroz, M. M., Wamba, S. FNath, S. D., (2022), Lu, L. (2021), Nazim, N. J. N. B., (2021), Surarityothin, P., (2022).	1335
Competitive Pressure	6	Fernando, Y., (2022), Hashimy, L., Jain. (2022), Lu, L. (2021), Li, C., Zhang, (2022), Turhan, C., & Akman, I. (2021), Wong, L., (2020)	1163
Compatibility	10	Afifa, M. A., (2022), Alazab, M., Alhyari, (2021), Bhardwaj, A. (2021), Chittipaka, V., (2022), Fernando, Y., (2022), Li, C., Zhang, (2022), Malik, S., (2021), Nath, S. D., (2022), Paththinige, P., (2022), Ullah, N (2021).	2974
Perceived Behavioral Control	4	Cheng, M., & Chong, H. (2022), Kamble, S. S., (2019), Prisco, A., Abdallah, (2022)	973

Top Management Support	11	Bhardwaj, A. (2021), Fernando, Y., (2022), Hashimy, L., Jain. (2022), Lin, H. (2023), Li, C., Zhang, (2022), Lu, L. (2021), Malik, S., (2021), Nath, S. D., (2022), Paththinige, P., (2022), Turhan, C., & Akman, I. (2021), Wong, L., (2020)	2442
Government Support	10	Bhardwaj, A. (2021), Chittipaka, V., (2022), Fernando, Y., (2022), Li, C., Zhang, (2022), Lin, H. (2023), Lu, L. (2021), Malik, S., (2021), Mulaji, S. (2022), Nath, S. D., (2022), Wong, L., (2020)	2601
Organizational Readiness	7	Turhan,C.,&Akman,I.(2021), Lu,L.(2021), Lin,H.(2023), Mulaji,S.(2022), Nath,S.D.,(2022), Turhan,C.,&Akman,I.(2021), Alazab,M.,Alhyari,(2021)	2338
Trust	6	Afifa, M. A., (2022), Chittipaka, V., (2022), Gao, S., & Li, Y. (2021), Queiroz, M. M., Wamba, S. FNath, S. D., (2022), Nath, S. D., (2022), Liu, N., & Ye, Z. (2021)	2140
Firm Size	3	Chittipaka, V., (2022), Fernando, Y., (2022), Li, C., Zhang, (2022)	892
Cost	4	Wong, L., (2020), Bhardwaj, A. (2021), Li, C., Zhang, (2022), Paththinige, P., (2022)	710

Table 5: Factors distribution among studies

CHAPTER 6: DISCUSSION

The aim of this investigation was to provide a comprehensive understanding of the determinants that influence the acceptance of blockchain technology by analyzing quantitative data from multiple research studies. By examining the relationships between various factors and the intention to adopt blockchain technology, this study aimed to enhance our knowledge of the motivators behind its adoption in organizations. The research focused on identifying key determinants that affect the adoption of blockchain technology across diverse organizational settings. The findings have significant implications for scholars, professionals, and policymakers who are interested in promoting the adoption of blockchain technology and leveraging its potential benefits (Kouhizadeh et al., 2021).

To examine the impact of different factors on the intention to adopt blockchain technology, this study utilized the Unified Theory of Acceptance and Use of Technology (UTAUT) model as the theoretical framework. The UTAUT model incorporates several existing models (TRA, TPB, TAM, DOI, extended TAM, motivational model, social cognitive theory, and the model of PC utilization), which collectively address most of the factors influencing technology adoption (Francisco & Swanson, 2018). Specifically, the study examined the effects of performance expectancy (perceived usefulness and relative advantage), effort expectancy (perceived ease of use and complexity), social influence (subjective norms, social influence, and competitive pressure), and facilitating conditions (compatibility, perceived behavioral control, top management support, governmental support, and organizational readiness) on the intention to adopt blockchain technology.

Additionally, this study considered the influence of trust, firm size, and cost, as these factors were consistently mentioned in the literature reviewed.

The results of the analysis revealed several important findings. The factors with the largest effect sizes in relation to the intention to adopt blockchain technology were firm size, perceived usefulness, relative advantages and compatibility. These factors indicate that organizations with larger sizes may be more likely to adopt blockchain technology because they are more mature in the implementation of technologies. Perceived usefulness is significant determinants of adoption decisions (Clohessy & Acton, 2019). On the other hand, factors such as complexity, government support, and cost did not show significant relationships with the intention to adopt blockchain technology (Alazab et al., 2021).

When comparing these results with existing literature, it is important to note both similarities and differences. While some previous studies have also highlighted the significance of factors such as firm size, perceived ease of use, and perceived usefulness (Nuryyev et al., 2020; Prisco et al., 2022; Lamoreaux, 2022), this study contributes by providing a comprehensive synthesis of multiple studies, enhancing the robustness of the findings. Additionally, the non-significant relationships identified in this study, such as complexity, government support, and cost, suggest that these factors may not be as influential as previously assumed in the context of blockchain adoption (Liang et al., 2021; Queiroz & Wamba, 2019; Alazab et al., 2021).

Consistent with our research, a further meta-analysis regarding the antecedents and outcomes associated with the adoption of blockchain technology which applied an extended technology-organization-environment (TOE) framework. The adoption of blockchain technology is influenced by primary factors like perceived usefulness, perceived ease of use, trust and security and social Influence, as identified by Grover et al. (2019) whereas Ullah et al. (2020) identified that adoption of blockchain is supported by the factors such as cost saving and innovativeness. The results of this meta-analysis are consistent to our findings on the positive effect of perceived usefulness, perceived ease of used, trust and social influence in the intention to adopt blockchain technology; however, they did not study the firm size effect. Cost was significant in their results but has no significant effect in our meta-analysis. However, both results cannot be compared because of the inconsistency in the cost definition in both papers. In our meta-analysis we consider the cost of implementing the blockchain technology. However, in their meta-analysis they considered perceived cost benefits (PCB) encompass the perceived advantages that individuals or organizations anticipate receiving when they adopt technology. Considering both definitions, we can realize that both results are logical.

At a managerial level, the study's implications hold great significance for organizations that are contemplating the adoption and execution of blockchain technology. The results underscore the significance of various pivotal elements that necessitate consideration in decision-making procedures. Results reveals that firm size plays a crucial role in determining the adoption of blockchain technology (Chittipaka et al., 2022), indicating that larger organizations are more likely to embrace this technology because they are ready by resources to adopt new technology. This suggests that smaller entities may be required to devise a plan and tackle particular obstacles linked to the implementation of this technology.

Despite that our meta-analysis indicate the small relationship between the perceived ease of use and the intention to adopt blockchain technology, however, it is still significant relationship consistence with other studies. The perceived ease of use and perceived usefulness are significant determinants that impact the adoption of blockchain technology (Nuryyev et al., 2020). It is imperative for organizations to focus on shaping the perception of their employees that blockchain technology is both user-friendly and advantageous to their work processes. The aforementioned objectives can be attained by means of education and training, of the advantages of the technology, and adopting tools that are easy to use.

The concept of relative advantages underscores the significance of organizations to convey the benefits and merits of adopting blockchain technology (Prisco et al., 2022; Lamoreaux, 2022) in contrast to other alternatives. Emphasizing the potential enhancements in operational efficiency, automation, and strengthened trust and verification mechanisms can serve as compelling rationales for embracing a particular course of action.

Furthermore, the absence of statistically significant associations discovered in this investigation, namely complexity, governmental support, and cost, implies that enterprises ought to meticulously assess these variables before contemplating the adoption of blockchain technology (Liang et al., 2021). Although these factors were previously considered substantial obstacles, their impact on the determination to adopt may now be less prominent. Those factors might not affect the intentions but may affect actual use. Organizations are convinced of the benefits of the technology and thus they intend to use it however the decision to actually use it will be affected by government support

This underscores the necessity for entities to evaluate their unique circumstances and consider the advantages and drawbacks of implementing blockchain technology.

Overall, our meta-analysis provides valuable insights for organizations considering adopting blockchain technology. Our findings suggest that organizations should focus on improving the perceived usefulness and ease of use of blockchain technology to increase user acceptance and use behavior. In addition, organizations should consider the compatibility of this technology with their existing systems and processes.

Moreover, organizations should address trust issues by implementing robust security measures and providing transparency in their operations. Despite that the cost associated with implementing blockchain technology was not supported in this analysis, organizations should carefully consider the costs associated with adopting this technology and assess its potential benefits before making a decision

6.1 Limitations and Future Implications

The selected studies exhibited differences in methodologies and contexts, contributing to the heterogeneity of the findings. Subsequent investigations ought to tackle these constraints by encompassing unreleased research and utilizing meticulous methodologies. The research centered on identifying determinants, however, it did not delve into the fundamental mechanisms that drive adoption. Subsequent studies may explore the mediating and moderating variables to enhance comprehension of the adoption phenomenon. The rapid developments in blockchain technology necessitate future research endeavors to scrutinize distinct blockchain applications across various industries, in order to effectively identify industry-specific prospects and challenges. It is imperative for policymakers and industry experts to engage in collaborative efforts aimed at establishing regulatory frameworks and standards that are conducive to the growth and development of the industry. The successful adoption of blockchain technology hinges upon the resolution of legal and regulatory obstacles, the mitigation of data privacy apprehensions, and the facilitation of interoperability among blockchain networks. Subsequent investigations ought to integrate current information, tackle the issue of publication bias, delve into fundamental mechanisms, and scrutinize implications that are specific to certain contexts. The aforementioned action is expected to augment our comprehension of the adoption of blockchain technology and expedite its assimilation into a wide range of organizational contexts. Additionally, our analysis only included peer-reviewed articles published in English, which may limit the generalizability of our findings to non-English speaking populations. Finally, analysis was limited to articles published between 2019 and 2023, which may not capture the earlier studies regarding the adoption of blockchain technology.

CHAPTER 7: CONCLUSION

The present study has provided significant insights into the determinants that impact the intention to adopt blockchain technology within organizational contexts. Through the implementation of a meta-analytic approach on a sample of 27 studies, we have successfully identified key determinants that significantly influence the decision-making process of adoption. The results emphasize the significance of several factors, including the size of the organization, the perceived usefulness, and the relative advantages, in influencing the likelihood of adopting blockchain technology.

The present study's theoretical significance lies in its ability to integrate quantitative data from various studies and offer a comprehensive synthesis of the factors that influence the adoption of blockchain technology, thus contributing to the existing knowledge base. The findings are consistent with prior studies that underscore the importance of variables such as firm size, perceived utility and relative advantage.

The results of this study hold significance for enterprises contemplating the integration and execution of blockchain technology, from a pragmatic standpoint. The findings emphasize the significance of taking into account variables such as the magnitude of the organization, perceived level of usefulness in the process of making decisions and relative advantages gained from the technology. It is imperative for organizations to acknowledge the potential advantages of blockchain technology, such as enhanced operational efficiencies, trust and verification mechanisms automation, asset tokenization, interoperability, and opportunities for innovation.

Recommendations

An in-depth understanding of the main determinants of blockchain acceptance may be gained by doing a meta-analysis of the factors that directly influence the adoption of blockchain technology in various companies. Here are some suggestions for how to approach a meta-analysis on this subject:

- To start, undertake a thorough analysis of the available literature on the adoption of blockchain in various enterprises. To find pertinent studies, look through credible industry publications, academic journals, and conference proceedings. This stage will assist in determining the variables that have already been looked at and their effect on blockchain adoption.
- Establish precise inclusion and exclusion standards for choosing studies for the meta-analysis. The publication year, study design, sample size, industry sector, and particular aspects evaluated might all be considered. This will guarantee the inclusion of top-notch papers that satisfy the study's goals.
- Take pertinent information about the factors looked at, the research techniques, the features of the sample, and conclusions on the adoption of blockchain technology. Create a coding system to classify and organize the retrieved data, ensuring accuracy and consistency in the analysis.
- Calculate the impact sizes for each element that was evaluated in the chosen studies in order to analyze effect sizes. Depending on the type of data given in the studies, common effect size estimates in meta-analysis include odds ratios, correlation coefficients, or normalized mean differences. The extent and direction of the association between factors and blockchain adoption are quantified by effect

sizes.

- To decide whether a meta-analysis is necessary, assess the heterogeneity among the chosen papers. Variations in study design, sample characteristics, or environmental factors can all lead to heterogeneity. To evaluate the heterogeneity, think about applying statistical tests like Cochran's Q test and I2 statistic.
- Conduct a meta-regression analysis to investigate potential moderating factors that could account for the variation in factors' impacts on blockchain adoption. Industry sector, organization size, location, or publication year are examples of these moderating variables. Finding contextual or methodological factors that affect the link between variables and blockchain adoption is made easier with the aid of meta-regression.
- Synthesize the results from the chosen studies and discover the critical elements that repeatedly emerge as important determinants of blockchain adoption in various enterprises. at get at solid conclusions, take into account the statistical significance, effect sizes, and relevant moderating factors.
- Talk about how the meta-analysis's findings will affect both practice and research. Provide tips for businesses looking to embrace blockchain technology and highlight the elements that have the biggest impact on acceptance. Determine where there are gaps in the material currently available and suggest directions for further study to better understand blockchain usage.

These suggestions can help a meta-analysis give a thorough knowledge of the variables affecting the adoption of blockchain technology across various enterprises. It provides information that can help organizational strategies and decision-making procedures involving the deployment of blockchains.

REFERENCES

Acciarini, C., Cappa, F., Di Costanzo, G., Prisco, M., Sardo, F., Stazzone, A., & Stoto, C. (2023). Blockchain technology to protect label information: the effects on purchase intentions in the food industry. Computers & Industrial Engineering, 180, 109276. https://doi.org/10.1016/j.cie.2023.109276

Afifa, M. M. A., Van, H. V., & Van, T. L. H. (2022). Blockchain adoption in accounting by an extended UTAUT model: empirical evidence from an emerging economy. *Journal of Financial Reporting and Accounting*.

Agi, M. A., & Jha, A. K. (2022). Blockchain technology in the supply chain: An integrated theoretical perspective of organizational adoption. *International Journal of Production Economics*, *247*, 108458.

Ajzen, I., & Fishbein, M. (1975). A Bayesian analysis of attribution processes. *Psychological bulletin*, *82*(2), 261.

Alazab, M., Alhyari, S., Awajan, A., & Abdallah, A. B. (2021). Blockchain technology in supply chain management: an empirical study of the factors affecting user adoption/acceptance. *Cluster Computing*, *24*, 83-101

Alazab, Moutaz & Alhyari, Salah & Awajan, Albara & Abdallah, Ayman. (2021). Blockchain technology in supply chain management: an empirical study of the factors affecting user adoption/acceptance. Cluster Computing. 24. 10.1007/s10586-020-03200-4.

Albeshr, S., & Nobanee, H. (2020). Blockchain applications in banking industry: A mini-review. *Available at SSRN 3539152*.

Al-Gahtani, S. S., Hubona, G. S., & Wang, J. (2007). Information technology (IT) in Saudi Arabia: Culture and the acceptance and use of IT. *Information & management*, *44*(8), 681-691.

Alzahrani, S., Daim, T., & Choo, K. K. R. (2022). Assessment of the blockchain technology adoption for the management of the electronic health record systems. *IEEE Transactions on Engineering Management*.

Alkhateeb, A., Catal, C., Kar, G., & Mishra, A. (2022). Hybrid blockchain platforms for the internet of things (IoT): A systematic literature review. *Sensors*, *22*(4), 1304.

Alazab, M., Alhyari, S., Awajan, A., & Abdallah, A. B. (2021). Blockchain technology in supply chain management: an empirical study of the factors affecting user adoption/acceptance. *Cluster Computing*, *24*, 83-101.

ALAKLABI, S., & KANG, K. (2021). Perceptions towards cryptocurrency adoption: A case of Saudi Arabian citizens. *Journal of electronic banking systems*.

Alketbi, A., Nasir, Q., & Talib, M. A. (2018, February). Blockchain for government services—Use cases, security benefits and challenges. In *2018 15th Learning and Technology Conference (L&T)* (pp. 112-119). IEEE.

Banerjee, A. (2023). An in-depth look at blockchain technology: Architecture and security concerns. In Elsevier eBooks (pp. 297–325). https://doi.org/10.1016/b978-0-323-96146-2.00023-1

Beck, R., Müller-Bloch, C., & King, J. L. (2018). Governance in the Blockchain Economy: A Framework and Research Agenda. Journal of the Association for Information Systems, 19(10), 1029-1042.

Benzidia, S., Makaoui, N., & Subramanian, N. (2021). Impact of ambidexterity of blockchain technology and social factors on new product development: A supply chain and Industry 4.0 perspective. *Technological Forecasting and Social Change*, *169*, 120819

Bhardwaj, A., Garg, A., & Gajpal, Y. (2021). Determinants of blockchain technology adoption in supply chains by small and medium enterprises (SMEs) in India. *Mathematical Problems in Engineering*, *2021*, 1-14.

Callinan, C., Vega, A., Clohessy, T., & Heaslip, G. (2022). Blockchain adoption factors, enablers, and barriers in fisheries supply chain: preliminary findings from a systematic literature review. *The Journal of The British Blockchain Association*, 32437.

Chang, I. C., Hwang, H. G., Hung, W. F., & Li, Y. C. (2007). Physicians' acceptance of pharmacokinetics-based clinical decision support systems. *Expert systems with applications*, *33*(2), 296-303.

Chaveesuk, S., Khalid, B., & Chaiyasoonthorn, W. (2020, June). Understanding stakeholders needs for using blockchain based smart contracts in construction industry of Thailand: extended TAM framework. In *2020 13th International Conference on Human System Interaction (HSI)* (pp. 137-141). IEEE.

Cheng, M., & Chong, H. Y. (2022). Understanding the Determinants of Blockchain Adoption in the Engineering-Construction Industry: Multi-Stakeholders' Analyses. *IEEE Access*, *10*, 108307-108319.

Chepurnoy, A. (2017). TwinsCoin: A Cryptocurrency via Proof-of-Work and Proof-of-Stake. https://eprint.iacr.org/2017/232

Chittipaka, V., Kumar, S., Sivarajah, U., Bowden, J. L. H., & Baral, M. M. (2022). Blockchain Technology for Supply Chains operating in emerging markets: an empirical examination of technology-organization-environment (TOE) framework. *Annals of Operations Research*, 1-28.

Choi, T. M. (2021). Creating all-win by blockchain technology in supply chains: Impacts of agents' risk attitudes towards cryptocurrency. *Journal of the Operational Research Society*, *72*(11), 2580-2595.

Chowdhury, S., Rodriguez-Espindola, O., Dey, P., & Budhwar, P. (2022). Blockchain technology adoption for managing risks in operations and supply chain management: evidence from the UK. *Annals of operations research*, 1-36.

Clohessy, T., & Acton, T. (2019). Investigating the influence of organizational factors on blockchain adoption: An innovation theory perspective. *Industrial Management & Data Systems*, *119*(7), 1457-1491

Clohessy, T., Acton, T., & Rogers, N. (2019). Blockchain adoption: Technological, organisational and environmental considerations. *Business Transformation through Blockchain: Volume I*, 47-76.

Cohen, J. (1988). Set correlation and contingency tables. *Applied psychological measurement*, *12*(4), 425-434.

Dinh, T. T. A., Wang, J., Chen, G., Liu, R., Ooi, B. C., & Tan, K. L. (2017, May). Blockbench: A framework for analyzing private blockchains. In *Proceedings of the 2017 ACM international conference on management of data* (pp. 1085-1100).

Du, X., Chen, B., Ma, M., & Zhang, Y. (2021). Research on the application of blockchain in smart healthcare: constructing a hierarchical framework. *Journal of Healthcare Engineering*, *2021*.

Duan, J., Zhang, C., Gong, Y., Brown, S., & Li, Z. (2020). A content-analysis based literature review in blockchain adoption within food supply chain. *International journal of environmental research and public health*, *17*(5), 1784.

Dwivedi, Y. K., Rana, N. P., Jeyaraj, A., Clement, M., & Williams, M. D. (2019). Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model. *Information Systems Frontiers*, *21*, 719-734.

Eckhardt, A., Laumer, S., & Weitzel, T. (2009). Who influences whom? Analyzing workplace referents' social influence on IT adoption and non-adoption. Journal of information technology, 24(1), 11-24.

Ferdous, S., Chowdhury, M. A., & Hoque, M. O. (2021). A survey of consensus algorithms in public blockchain systems for crypto-currencies. Journal of Network and Computer Applications, 182, 103035. https://doi.org/10.1016/j.jnca.2021.103035

Fernando, Y., Tseng, M. L., Wahyuni-TD, I. S., Sroufe, R., & Mohd-Zailani, N. I. A. (2022). Blockchain technology adoption for carbon trading and energy efficiency: ISO manufacturing firms in Malaysia. *International Journal of Logistics Research and Applications*, 1-22.

Francisco, K., & Swanson, D. (2018). The supply chain has no clothes: Technology adoption of blockchain for supply chain transparency. *Logistics*, *2*(1), 2

Gad, A., Mosa, D. T., Abualigah, L., & Abohany, A. (2022, March 1). Emerging Trends in Blockchain Technology and Applications: A Review and Outlook. Journal of King Saud University - Computer and Information Sciences. https://doi.org/10.1016/j.jksuci.2022.03.007

Gao, S., & Li, Y. (2021). An empirical study on the adoption of blockchain-based games from users' perspectives. *The Electronic Library*, *39*(4), 596-614.

Gorkhali, A., Li, L., & Shrestha, A. (2020). Blockchain: A literature review. *Journal of Management Analytics*, *7*(3), 321-343.

Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology*, *50*(5), 2572-2593

Grover, P., Kar, A. K., Janssen, M., & Ilavarasan, P. V. (2019). Perceived usefulness, ease of use and user acceptance of blockchain technology for digital transactions–insights from user-generated content on Twitter. *Enterprise Information Systems*, *13*(6), 771-800.

Guan, W., Ding, W., Zhang, B., & Verny, J. (2023). The role of supply chain alignment in coping with resource dependency in blockchain adoption: empirical evidence from China. *Journal of Enterprise Information Management*, (ahead-of-print).

Gupta, B., Dasgupta, S., & Gupta, A. (2008). Adoption of ICT in a government organization in a developing country: An empirical study. *The Journal of Strategic Information Systems*, *17*(2), 140-154.

Gururaj, H. L., Manoj Athreya, A., Kumar, A. A., Holla, A. M., Nagarajath, S. M., & Ravi Kumar, V. (2020). Blockchain: A new era of technology. *Cryptocurrencies and blockchain technology applications*, 1-24.

Habib, G., Sharma, S., Ibrahim, S., Ahmad, I., Qureshi, S., & Ishfaq, M. (2022). Blockchain Technology: Benefits, Challenges, Applications, and Integration of Blockchain Technology with Cloud Computing. *Future Internet*, *14*(11), 341.

Haque, A. K. M., & Rahman, M. (2020). Blockchain technology: methodology, application and security issues. *arXiv preprint arXiv:2012.13366*.

Hamdan, I. K., Aziguli, W., Zhang, D., Sumarliah, E., & Usmanova, K. (2022). Forecasting blockchain adoption in supply chains based on machine learning: Evidence from Palestinian food SMEs. *British Food Journal*.

Hamdan, I. K., Aziguli, W., Zhang, D., Sumarliah, E., & Usmanova, K. (2022). Forecasting blockchain adoption in supply chains based on machine learning: Evidence from Palestinian food SMEs. *British Food Journal*.

Hashimy, L., Jain, G., & Grifell-Tatjé, E. (2023). Determinants of blockchain adoption as decentralized business model by Spanish firms–an innovation theory perspective. *Industrial Management & Data Systems*, *123*(1), 204-228.

Hastig, G. M., & Sodhi, M. S. (2020). Blockchain for supply chain traceability: Business requirements and critical success factors. *Production and Operations Management*, *29*(4), 935-954.

Higgins, J., Tompson, S., Deeks, J., & Altman, D. (2003). A meta-analysis on the effectiveness of smart-learning. *Bmj*, *327*(1), 557-560.

Higgins, J. P., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *Bmj*, *327*(7414), 557-560.

Iansiti, M., & Lakhani, K. R. (2017). The Truth About Blockchain. Harvard Business Review, 95(1), 118-127.

Im, I., Hong, S., & Kang, M. S. (2011). An international comparison of technology adoption: Testing the UTAUT model. *Information & management*, *48*(1), 1-8.

Jami Pour, M., Mesrabadi, J., & Asarian, M. (2021). Meta-analysis of the DeLone and McLean models in e-learning success: the moderating role of user type. Online Information Review, ahead-of-p. https://doi.org/10.1108/OIR-01-2021-0011

Jena, R. K. (2022). Examining the factors affecting the adoption of blockchain technology in the banking sector: An extended UTAUT model. *International Journal of Financial Studies*, *10*(4), 90

Jovanovic, M., Kostić, N., Sebastian, I. M., & Sedej, T. (2022). Managing a blockchain-based platform ecosystem for industry-wide adoption: The case of TradeLens. *Technological Forecasting and Social Change*, *184*, 121981.

Kamble, S., Gunasekaran, A., & Arha, H. (2019). Understanding the Blockchain technology adoption in supply chains-Indian context. *International Journal of Production Research*, *57*(7), 2009-2033.

Khan, A. G., Zahid, A. H., Hussain, M., Farooq, M., Riaz, U., & Alam, T. M. (2019, November). A journey of WEB and Blockchain towards the Industry 4.0: An Overview. In *2019 International Conference on Innovative Computing (ICIC)* (pp. 1-7). IEEE.

Kim, J. W. (2020). Blockchain technology and its applications: case studies. *Journal of System and Management Sciences*, *10*(1), 83-93.

Kouhizadeh, M., Saberi, S., & Sarkis, J. (2021). Blockchain technology and the sustainable supply chain: Theoretically exploring adoption barriers. *International Journal of Production Economics*, *231*, 107831.

Lamoreaux, A. (2022). *Blockchain: Are Managers Linked In?* (Doctoral dissertation, Creighton University).

Lee, S., Yu, J., & Jeong, D. (2015). BIM acceptance model in construction organizations. *Journal of management in engineering*, *31*(3), 04014048.

Li, J. (2020, April). Blockchain technology adoption: Examining the fundamental drivers. In *Proceedings of the 2020 2nd international conference on management science and industrial engineering* (pp. 253-260).

Li, C., Zhang, Y., & Xu, Y. (2022). Factors Influencing the Adoption of Blockchain in the Construction Industry: A Hybrid Approach Using PLS-SEM and fsQCA. *Buildings*, *12*(9), 1349.

Li, X., Jiang, P., Chen, T., Luo, X., & Wen, Q. (2017). A survey on the security of blockchain systems. Future Generation Computer Systems, 107, 841–853. https://doi.org/10.1016/j.future.2017.08.020

Liang, T. P., Kohli, R., Huang, H. C., & Li, Z. L. (2021). What drives the adoption of the blockchain technology? A fit-viability perspective. *Journal of Management Information Systems*, *38*(2), 314-337.

Lin, H. F. (2023). Blockchain adoption in the maritime industry: empirical evidence from the technological-organizational-environmental framework. *Maritime Policy & Management*, 1-23.

Liu, N., & Ye, Z. (2021). Empirical research on the blockchain adoption–based on TAM. *Applied Economics*, *53*(37), 4263-4275.

Liu, P., & Lu, C. (2021). Strategic analysis and development plan design on digital transformation in the energy industry: A global perspective. *International Journal of Energy Research*, *45*(14), 19657-19670.

Lu, L., Liang, C., Gu, D., Ma, Y., Xie, Y., & Zhao, S. (2021). What advantages of blockchain affect its adoption in the elderly care industry? A study based on the technology–organisation–environment framework. *Technology in Society*, *67*, 101786.

Lutfi, A., Al-Khasawneh, A. L., Almaiah, M. A., Alshira'h, A. F., Alshirah, M. H., Alsyouf, A., ... & Ali, R. A. (2022). Antecedents of Big Data Analytic Adoption and Impacts on Performance: Contingent Effect. *Sustainability*, *14*(23), 15516.

Marikyan, D. & Papagiannidis, S. (2023) Technology Acceptance Model: A review. In S. Papagiannidis (Ed), TheoryHub Book. Available at http://open.ncl.ac.uk / ISBN: 9781739604400

Malik, S., Chadhar, M., Vatanasakdakul, S., & Chetty, M. (2021). Factors affecting the organizational adoption of blockchain technology: Extending the technology–organization–environment (TOE) framework in the Australian context. *Sustainability*, *13*(16), 9404.

Maddikunta, P. K. R., Pham, Q. V., Prabadevi, B., Deepa, N., Dev, K., Gadekallu, T. R., ... & Liyanage, M. (2022). Industry 5.0: A survey on enabling technologies and potential applications. *Journal of Industrial Information Integration*, *26*, 100257.

Marikyan, D. & Papagiannidis, S. (2023) Unified Theory of Acceptance and Use of Technology: A review. In S. Papagiannidis (Ed), TheoryHub Book.

Matlebjane, D. A., & Ndayizigamiye, P. (2022). Antecedents of the adoption of blockchain to enhance patients' health information management in South Africa. *South African Journal of Information Management*, *24*(1), 1-9.

Mensah, I. K., & Mwakapesa, D. S. (2022). The Drivers of the Behavioral Adoption Intention of BITCOIN Payment from the Perspective of Chinese Citizens. *Security and Communication Networks*, *2022*.

Mthimkhulu, A., & Jokonya, O. (2022). Exploring the factors affecting the adoption of blockchain technology in the supply chain and logistic industry. *Journal of Transport and Supply Chain Management*, *16*, 750.

Mulaji, S. M., & Roodt, S. (2022). Factors Affecting Organisations' Adoption Behaviour toward Blockchain-Based Distributed Identity Management: The Sustainability of Self-Sovereign Identity in Organisations. *Sustainability*, *14*(18), 11534.

Mun, Y. Y., Jackson, J. D., Park, J. S., & Probst, J. C. (2006). Understanding information technology acceptance by individual professionals: Toward an integrative view. *Information & management*, *43*(3), 350-363.

Nath, S. D., Khayer, A., Majumder, J., & Barua, S. (2022). Factors affecting blockchain adoption in apparel supply chains: does sustainability-oriented supplier development play a moderating role?. *Industrial Management & Data Systems*, (ahead-of-print).

Nazim, N. F., Razis, N. M., & Hatta, M. F. M. (2021). Behavioural intention to adopt blockchain technology among bankers in islamic financial system: Perspectives in Malaysia. *Romanian Journal of Information Technology and Automatic Control*, *31*(1), 11-28.

Noor, A. (2022). Adoption of Blockchain Technology Facilitates a Competitive Edge for Logistic Service Providers. *Sustainability*, *14*(23), 15543.

Nguyen, H., B., & Luan, T., N. (2021). Factors Influence Blockchain Adoption in Supply Chain Management Among Companies Based in Ho Chi Minh City. Advances in Economics, Business and Management Research, 198.

Nuryyev, G., Wang, Y. P., Achyldurdyyeva, J., Jaw, B. S., Yeh, Y. S., Lin, H. T., & Wu, L. F. (2020). Blockchain technology adoption behavior and sustainability of the business in tourism and hospitality SMEs: An empirical study. *Sustainability*, *12*(3), 1256.

OECD. (2020). Opportunities and Challenges of Blockchain Technologies in Health Care. Retrieved from https://www.oecd.org/finance/Opportunities-and-Challenges-of-Blockchain-Technologies-in-Health-Care.pdf
https://www.himss.org/resources/blockchain-healthcare

Oke, A. E., Aliu, J., Jamir Singh, P. S., Onajite, S. A., Shaharudin Samsurijan, M., & Azura Ramli, R. (2023). Appraisal of awareness and usage of digital technologies for sustainable wellbeing among construction workers in a developing economy. *International Journal of Construction Management*, 1-9.

Panel, E. (2022, June 10). 15 Industries That Could Significantly Benefit From Blockchain
Technology. Forbes. https://www.forbes.com/sites/forbestechcouncil/2022/06/10/15-industries-that-could-significantly-benefit-from-blockchain-technology/?sh=659ec4f7af21

Panghal, A., Manoram, S., Mor, R. S., & Vern, P. (2023, January). Adoption challenges of blockchain technology for reverse logistics in the food processing industry. In *Supply Chain Forum: An International Journal* (Vol. 24, No. 1, pp. 7-16). Taylor & Francis.

Park, K. O. (2020). A study on sustainable usage intention of blockchain in the big data era: Logistics and supply chain management companies. *Sustainability*, *12*(24), 10670.

Neelesh. K. (2023). Authorization and privacy preservation in cloud-based distributed ehr system using blockchain technology and anonymous digital ring signature. Health Services and Outcomes Research Methodology. https://doi.org/10.1007/s10742-022-00281-z

Paththinige, P., & Rajapakse, C. (2022, September). Evaluating the Factors that Affect the Adoption of Blockchain Technology in the Pharmaceutical Supply Chain-A Case Study from Sri Lanka. In *2022 International Research Conference on Smart Computing and Systems Engineering (SCSE)* (Vol. 5, pp. 363-370). IEEE.

Paththinige, P. W., & Rajapakse, C. (2021). Challenges of Adopting Blockchain Technology to Pharmaceutical Supply Chain–A Case Study from Sri Lankan Health Sector.

Paul, P., Aithal, P. S., & Saavedra, R. (2021). Blockchain Technology and its Types—A Short Review. *International Journal of Applied Science and Engineering (IJASE)*, *9*(2), 189-200.

Peterson, R. A., & Brown, S. P. (2005). On the Use of Beta Coefficients in Meta-Analysis. *Journal of Applied Psychology, 90*(1), 175–181. https://doi.org/10.1037/0021-9010.90.1.175

Polas, M. R. H., Jahanshahi, A. A., Kabir, A. I., Sohel-Uz-Zaman, A. S. M., Osman, A. R., & Karim, R. (2022). Artificial Intelligence, Blockchain Technology, and Risk-Taking Behavior in the 4.0 IR Metaverse Era: Evidence from Bangladesh-Based SMEs. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(3), 168.

Pour, M. J., Mesrabadi, J., & Asarian, M. (2021, September 15). Meta-analysis of the DeLone and McLean models in e-learning success: the moderating role of user type. Online Information Review. https://doi.org/10.1108/oir-01-2021-0011

Prisco, A., Abdallah, Y. O., Morande, S., & Gheith, M. H. (2022). Factors affecting blockchain adoption in Italian companies: the moderating role of firm size. *Technology Analysis & Strategic Management*, 1-14

Puthal, D., Malik, N., Mohanty, S. P., Kougianos, E., & Das, G. (2018). Everything you wanted to know about the blockchain: Its promise, components, processes, and problems. *IEEE Consumer Electronics Magazine*, *7*(4), 6-14.

Queiroz, M. M., & Wamba, S. F. (2019). Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management*, *46*, 70-82.

Sadik, S., Ahmed, M., Sikos, L. F., & Islam, A. N. (2020). Toward a sustainable cybersecurity ecosystem. *Computers*, *9*(3), 74.

Salah, K., Rehman, M. H. U., Nizamuddin, N., & Al-Fuqaha, A. (2019). Blockchain for AI: Review and open research challenges. *IEEE Access*, *7*, 10127-10149.

Salem, S. (2019). A proposed adoption model for blockchain technology using the unified theory of acceptance and use of technology (UTAUT). Open international journal of informatics, 7(Special Issue 2), 75-84.

Scott, B., Loonam, J., & Kumar, V. (2017, September 1). Exploring the rise of blockchain technology: Towards distributed collaborative organizations. Strategic Change. https://doi.org/10.1002/jsc.2142

Sedlmeir, J., Buhl, H. U., Fridgen, G., & Keller, R. (2020). The energy consumption of blockchain technology: Beyond myth. *Business & Information Systems Engineering*, *62*(6), 599-608.

Sharif, M. M., & Ghodoosi, F. (2022). The ethics of blockchain in organizations. *Journal of Business Ethics*, *178*(4), 1009-1025.

Surarityothin, P., Kamhangwong, D., Fuggate, P., & Wicha, S. (2022, November). The Finding of Factors to Motivate Stakeholders in the Coffee Supply Chain Towards the Use of Blockchain Technology: Case of Chiang Rai Coffee Supply Chain. In *2022 6th International Conference on Information Technology (InCIT)* (pp. 422-427). IEEE.

Swan, M. (2015). Blockchain: Blueprint for a New Economy. O'Reilly Media.

Swan, M. (2021). *Blockchain*. Helion.

Tasatanattakool, P., & Techapanupreeda, C. (2018, January). Blockchain: Challenges and applications. In *2018 International Conference on Information Networking (ICOIN)* (pp. 473-475). IEEE.

Taherdoost, H. (2022). A critical review of blockchain acceptance models—blockchain technology adoption frameworks and applications. *Computers*, *11*(2), 24.

Teisserenc, B., & Sepasgozar, S. (2021). Project data categorization, adoption factors, and non-functional requirements for blockchain based digital twins in the construction industry 4.0. *Buildings*, *11*(12), 626.

Tokkozhina, U., Martins, A. L., & Ferreira, J. C. (2022). Use of Blockchain Technology to Manage the Supply Chains: Comparison of Perspectives between Technology Providers and Early Industry Adopters. *Journal of Theoretical and Applied Electronic Commerce Research*, *17*(4), 1616-1632

Tran, L. T. T., & Nguyen, P. T. (2021). Co-creating blockchain adoption: theory, practice and impact on usage behavior. *Asia Pacific Journal of Marketing and Logistics*, *33*(7), 1667-1684.

Turhan, C., & Akman, I. (2022). Exploring sectoral diversity in the timing of organizational blockchain adoption. *Information Technology & People*, *35*(7), 1912-1930.

T. Ncube, N. Dlodlo and A. Terzoli, "Private Blockchain Networks: A Solution for Data Privacy," *2020 2nd International Multidisciplinary Information Technology and Engineering Conference (IMITEC)*, Kimberley, South Africa, 2020, pp. 1-8, doi: 10.1109/IMITEC50163.2020.9334132.

Ullah, N., Alnumay, W. S., Al-Rahmi, W. M., Alzahrani, A. I., & Al-Samarraie, H. (2020). Modeling cost saving and innovativeness for blockchain technology adoption by energy management. *Energies*, *13*(18), 4783.

Vargas, S. (2022). Challenges of adopting blockchain technology in Higher Education Institutions.

Vu, N. H., Ghadge, A., & Bourlakis, M. (2021). Blockchain adoption in food supply chains: a review and implementation framework. Production Planning & Control, 1–18. https://doi.org/10.1080/09537287.2021.1939902

Wang, X., Liu, L., Liu, J., & Huang, X. (2022). Understanding the Determinants of Blockchain Technology Adoption in the Construction Industry. *Buildings*, *12*(10), 1709.

Weems, M. (2022, September 26). *Can blockchain solve health care's security problems? the financial industry offers a valuable case study*. STAT. https://www.statnews.com/2022/09/22/blockchain-health-care-hospitals-records/

Wong, L. W., Leong, L. Y., Hew, J. J., Tan, G. W. H., & Ooi, K. B. (2020). Time to seize the digital evolution: Adoption of blockchain in operations and supply chain management among Malaysian SMEs. *International Journal of Information Management*, *52*, 101997.

Woodside, Joseph M.; Augustine, Fred K. Jr.; and Giberson, Will (2017) "Blockchain Technology Adoption Status and Strategies," Journal of International Technology and Information Management: Vol. 26: Iss. 2, Article 4. DOI: https://doi.org/10.58729/1941-6679.1300 Available at: https://scholarworks.lib.csusb.edu/jitim/vol26/iss2/4

Wu, B., & Duan, T. (2019). The Advantages of Blockchain Technology in Commercial Bank Operation and Management. https://doi.org/10.1145/3340997.3341009

Venkatesh, Morris, Davis, & Davis (2003). User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly, 27 (3), 425.

Venkatesh, Thong, & Xu (2012). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. MIS Quarterly, 36 (1), 157.

Vivaldini, M., & de Sousa, P. R. (2021). Blockchain connectivity inhibitors: weaknesses affecting supply chain interaction and resilience. *Benchmarking: An International Journal*, *28*(10), 3102-3136.

Viriyasitavat, W., & Hoonsopon, D. (2019). Blockchain characteristics and consensus in modern business processes. *Journal of Industrial Information Integration*, *13*, 32-39

Xu, S., Zhou, L., & Zou, P. X. (2023). What influences stakeholders' decision in adopting blockchain-based quality tracking systems in prefabricated construction. *Engineering, Construction and Architectural Management*, (ahead-of-print).

Yli-Huumo, J., Ko, D., Choi, S., Park, S., & Smolander, K. (2016). Where is current research on blockchain technology?—a systematic review. *PloS one*, *11*(10), e0163477.

Yusof, H., Munir, M. F. M. B., Zolkaply, Z., Jing, C. L., Hao, C. Y., Ying, D. S., ... & Leong, T. K. (2018). Behavioral intention to adopt blockchain technology: Viewpoint of the banking institutions in Malaysia. *International Journal of Advanced Scientific Research and Management*, *3*(10), 274-279.

Yu, Z. (2022). A meta-analysis and bibliographic review of the effect of nine factors on online learning outcomes across the world. Education and Information Technologies, 27(2), 2457-2482.

Zheng, X., Zhu, Y., & Si, X. (2019). A survey on challenges and progresses in blockchain technologies: A performance and security perspective. *Applied Sciences*, *9*(22), 4731

APPENDIX

Afifa, M. A., Van, H. N., & Van, T. D. (2022). Blockchain adoption in accounting by an extended UTAUT model: empirical evidence from an emerging economy. Journal of Financial Reporting and Accounting, 21(1), 5–44. https://doi.org/10.1108/jfra-12-2021-0434

Alazab, M., Alhyari, S., Awajan, A. W., & Abdallah, A. B. (2021). Blockchain technology in supply chain management: an empirical study of the factors affecting user adoption/acceptance. Cluster Computing, 24(1), 83–101. https://doi.org/10.1007/s10586-020-03200-4

Cheng, M., & Chong, H. (2022). Understanding the Determinants of Blockchain Adoption in the Engineering-Construction Industry: Multi-Stakeholders' Analyses. IEEE Access, 10, 108307–108319. https://doi.org/10.1109/access.2022.3213714

Chittipaka, V., Kumar, S., Sivarajah, U., Bowden, J. L., & Baral, M. M. (2022). Blockchain Technology for Supply Chains operating in emerging markets: an empirical examination of technology-organization-environment (TOE) framework. Annals of Operations Research. https://doi.org/10.1007/s10479-022-04801-5

Chowdhury, S., Rodríguez-Espíndola, O., Dey, P. K., & Budhwar, P. (2022). Blockchain technology adoption for managing risks in operations and supply chain management: evidence from the UK. Annals of Operations Research. https://doi.org/10.1007/s10479-021-04487-1

Fernando, Y., Tseng, M., Wahyuni-Td, I. S., Sroufe, R., & Mohd-Zailani, N. I. A. (2022). Blockchain technology adoption for carbon trading and energy efficiency: ISO manufacturing firms in Malaysia. International Journal of Logistics, 1–22. https://doi.org/10.1080/13675567.2022.2090527

Gao, S., & Li, Y. (2021). An empirical study on the adoption of blockchain-based games from users' perspectives. The Electronic Library, 39(4), 596–614. https://doi.org/10.1108/el-01-2021-0009

Hashimy, L., Jain, G., & Grifell-Tatjé, E. (2022). Determinants of blockchain adoption as decentralized business model by Spanish firms – an innovation theory perspective. Industrial Management and Data Systems, 123(1), 204–228. https://doi.org/10.1108/imds-01-2022-0030

Kamble, S. S., Gunasekaran, A., & Arha, H. (2019). Understanding the Blockchain technology adoption in supply chains-Indian context. International Journal of Production Research, 57(7), 2009–2033. https://doi.org/10.1080/00207543.2018.1518610

Lin, H. (2023). Blockchain adoption in the maritime industry: empirical evidence from the technological-organizational-environmental framework. Maritime Policy & Management, 1–23.

Li, C., Zhang, Y., & Xu, Y. (2022). Factors Influencing the Adoption of Blockchain in the Construction Industry: A Hybrid Approach Using PLS-SEM and fsQCA. Buildings, 12(9), 1349. https://doi.org/10.3390/buildings12091349

Liu, N., & Ye, Z. (2021). Empirical research on the blockchain adoption – based on TAM. Applied Economics, 53(37), 4263–4275. https://doi.org/10.1080/00036846.2021.1898535

Lu, L., Liang, C., Gu, D., Ma, Y., Xie, Y., & Zhao, S. (2021). What advantages of blockchain affect its adoption in the elderly care industry? A study based on the technology–organisation–environment framework. Technology in Society, 67, 101786. https://doi.org/10.1016/j.techsoc.2021.101786

Malik, S., Chadhar, M., Vatanasakdakul, S., & Chetty, M. (2021). Factors Affecting the Organizational Adoption of Blockchain Technology: Extending the Technology–Organization–Environment (TOE) Framework in the Australian Context. Sustainability, 13(16), 9404. https://doi.org/10.3390/su13169404

Mulaji, S. S. M., & Roodt, S. (2022). Factors Affecting Organisations' Adoption Behaviour toward Blockchain-Based Distributed Identity Management: The Sustainability of Self-Sovereign Identity in Organisations. Sustainability, 14(18), 11534. https://doi.org/10.3390/su141811534

Nath, S. D., Khayer, A., Majumder, J., & Barua, S. (2022). Factors affecting blockchain adoption in apparel supply chains: does sustainability-oriented supplier development play a moderating role? Industrial Management and Data Systems, 122(5), 1183–1214. https://doi.org/10.1108/imds-07-2021-0466

Nazim, N. J. N. B., Razis, N., & Hatta, M. (2021). Behavioural intention to adopt blockchain technology among bankers in islamic financial system: perspectives in Malaysia. Revista Română De Informatică Şi Automatică, 31(1), 11–28. https://doi.org/10.33436/v31i1y202101

Paththinige, P., & Rajapakse, C. (2022). Evaluating the Factors that Affect the Adoption of Blockchain Technology in the Pharmaceutical Supply Chain - A Case Study from Sri Lanka. https://doi.org/10.1109/scse56529.2022.9905114

Prisco, A., Abdallah, Y. O., Morande, S., & Gheith, M. H. (2022). Factors affecting blockchain adoption in Italian companies: the moderating role of firm size. Technology Analysis & Strategic Management, 1–14. https://doi.org/10.1080/09537325.2022.2155511

Queiroz, M. M., Wamba, S. F., De Bourmont, M., & Telles, R. (2021, October 18). Blockchain adoption in operations and supply chain management: empirical evidence from an emerging economy. International Journal of Production Research. https://doi.org/10.1080/00207543.2020.1803511

Surarityothin, P., Kamhangwong, D., Fuggate, P., & Wicha, S. (2022). The Finding of Factors to Motivate Stakeholders in the Coffee Supply Chain Towards the Use of Blockchain Technology: Case of Chiang Rai Coffee Supply Chain. https://doi.org/10.1109/incit56086.2022.10067349

Ullah, N., Al-Rahmi, W. M., & Alkhalifah, A. (2021). Predictors for distributed ledger technology adoption: integrating three traditional adoption theories for manufacturing and service operations. Production and Manufacturing Research: An Open Access Journal, 9(1), 178–205. https://doi.org/10.1080/21693277.2021.1976963

Ullah, N., Al-Rahmi, W. M., Alzahrani, A. I., Alfarraj, O., & Alblehai, F. M. (2021). Blockchain Technology Adoption in Smart Learning Environments. Sustainability, 13(4), 1801. https://doi.org/10.3390/su13041801

Talukder, M., & Quazi, A. (2011). The Impact of Social Influence on Individuals' Adoption of Innovation. J. Org. Computing and E. Commerce, 21, 111–135. https://doi.org/10.1080/10919392.2011.564483

Turhan, C., & Akman, I. (2021). Exploring sectoral diversity in the timing of organizational blockchain adoption. Information Technology & People, 35(7), 1912–1930. https://doi.org/10.1108/itp-05-2020-0330

Walsh, C., O'Reilly, P. F., Gleasure, R., McAvoy, J. W., & O'Leary, K. D. (2021). Understanding manager resistance to blockchain systems. European Management Journal, 39(3), 353–365. https://doi.org/10.1016/j.emj.2020.10.001

Wang, X., Liu, L., Liu, J., & Huang, X. (2022). Understanding the Determinants of Blockchain Technology Adoption in the Construction Industry. Buildings, 12(10), 1709. https://doi.org/10.3390/buildings12101709

Wong, L., Leong, L., Hew, T., Tan, G. W., & Ooi, K. (2020). Time to seize the digital evolution: Adoption of blockchain in operations and supply chain management among Malaysian SMEs. International Journal of Information Management, 52, 101997. https://doi.org/10.1016/j.ijinfomgt.2019.08.005