# FACILITATORS AND BARRIERS TO THE MASS ADOPTION OF BLOCKCHAIN TECHNOLOGY: AN ORGANIZATIONAL LEVEL PERSPECTIVE


By

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# DECLARATION

I hereby state that no portion of the work referred to in this dissertation has been submitted in support of an application for another degree or qualification of this or any other University or institute of learning.

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# List of Symbols, Abbreviations and Acronyms

| | |
|---|---|
| BT | Blockchain Technology |
| TOE | Technology-Organization-Environment |
| CTO | Chief Technology Officer |
| NFT | Non-Fungible Token |
| IT | Information Technology |
| TAM | Technology Acceptance Model |
| TBP | Theory of Planned Behavior |
| UTAUT | Unified Theory of Acceptance and Use of Technology |
| DAO | Decentralized Autonomous Organization |
| DApps | Decentralized Applications |

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# Abstract

The blockchain technology is gaining recognition in various sectors for its benefits in information exchange, digital currency, payments, authenticity, and anti-counterfeiting. Despite these applications, the adoption rate of blockchain has slowed down, pertaining to the obscure barriers and limitations of tangible benefits of the technology. Prior work has predominantly focused on challenges faced in application or sector-based adoption of the technology, lacking a holistic understanding necessary for mainstream adoption. The research aims to study the facilitators and barriers to the mass adoption of blockchain technology for better understanding of the ever-changing dynamics at organization level. TOE Framework is used as a theoretical lens to explore the technological, organizational and environmental factors influencing the technology adoption. Data is collected from the blockchain experts, analysts and developers though semi-structured interviews. The research finds prominent factors such as lack of knowledge and expertise, dilemma of blockchain etc. as the key barriers to adoption. Moreover, the facilitators such as higher profitability, decentralization and digital applications etc. are the drivers for mainstream adoption. The research proposes a theoretical framework for better understanding towards mass adoption of blockchain technology.



**Keywords: blockchain technology, mass adoption, blockchain experts, TOE framework**

# Chapter 1: Introduction

Blockchain Technology (BT) has emerged as one of the most breakthrough technologies in the current era. The global market for blockchain technology is set to witness a whopping 82.8% surge in size, with an expected jump from 5.85 billion USD in 2021 to a staggering 1.23 trillion USD by 2030 (Best, 2023). This forecasted growth is a testament to the immense potential of blockchain technology and its impact on global markets. BT is capable of solving information management problems in almost all industries. The most popular use cases of technology are secure information exchange and digital currency, such as product authentication, anticounterfeiting, licensing and more. Despite these benefits, the adoption rate of Blockchain in organisations is reported to be only 8% in 2022, the second-lowest among emerging technologies (Nash, 2022). Therefore, there is a need to understand what are the barriers to blockchain technology and what is needed to facilitate its mass adoption.

Prior work suggests that the barriers to adoption are majorly regulatory uncertainty, lack of expert skills and trilemma of blockchain (insufficient trust, standardisation, scalability) (Lim, 2023; Sanka & Cheung, 2021; C. Wang & Zhao, 2023; Z. J. Wang et al., 2023). These barriers have overshadowed the numerous applications of blockchain, such as digital assets, ownership, authentication and customer engagement etc. (Hakkarainen & Colicev, 2023; Thanasi-Boçe et al., 2022; Z. J. Wang et al., 2023). Owing to the infancy stage of technology, businesses are reluctant to adopt it because the real value of this technology for existing business models is unclear. This lack of understanding and trust in the technology leads to investment indecisiveness. While Ethereum and Bitcoin are known to be the oldest blockchains with the most secure transactions and information exchange, issues like limited scalability, high gas fees and low transaction rate remains a key challenge in the adoption of technology at the mass level (Sanka & Cheung, 2021). For instance, companies have to compromise on the security and trust factors for scalable and cheaper blockchain solutions (ibid). This opens another can of worms, which is the incompatibility of multiple blockchains, network effect and more (Feldman, 2019).

Multiple studies have been found on the challenges faced in the adoption of the blockchain (Chan et al., 2023; Janssen et al., 2020; Malik et al., 2021; Sadhya & Sadhya, 2018; Yadav et al., 2020; L. Zhang et al., 2020). For instance, Chan conducted a case-study based research, exploring the challenges faced by telecom industry and proposed industry specific barriers such

as concerns regarding cyber security. They proposed a framework which highlighted the smart challenges faced by telecom companies and long-term growth opportunities (Chan et al., 2023). The research by Janssen was focused on change process in organizations for blockchain adoption. He highlighted the importance of institutional, market and technical factors influencing the adoption. However, the study does not provide the solutions towards these challenges and requests further research in this domain. (Janssen et al., 2020). The literature is focused on application-based challenges faced in various sectors such as improving sustainability through BT (AL-Issa et al., 2022), issues of scalability (Sanka & Cheung, 2021) and more. Despite extensive research, we lack a deeper understanding of the factors influencing the blockchain adoption. A holistic approach to comprehend the significant facilitators and barriers towards the mass adoption of blockchain is needed.

This research aims to examine the obstacles that hinder the widespread adoption and development of blockchain, as well as the facilitating factors that add real value and ensure alignment with business models. The study is designed with qualitative methodology with an interpretivist approach. The TOE framework provides the theoretical lens (Tornatzky et al., 1990) which is most widely used to elaborate on the technology adoption impact in an organizational context (Caldarelli et al., 2021; Khayer et al., 2020; Nath et al., 2022). This study employs TOE framework to study blockchain technology adoption at the organizational level because it caters to all the significant factors influencing organizational innovative technology adoptions (Clohessy & Acton, 2019b).

To understand the challenges of BT adoption, this study takes blockchain technology as research setting because of the potential use cases of blockchain in the sector such as product authentication, anticounterfeiting, digital ownership, supply chain management and traceability etc. (Caldarelli et al., 2021a; Hakkarainen & Colicev, 2023; Joy et al., 2022; Remme et al., 2022; Thanasi-Boçe et al., 2022). The sector is booming due to its rapid growth, million-dollars economy and dependability on innovative competitive advantage in the market. Thus, this study takes the blockchain technology into context for exploring the barriers to its adoption at the mass level.

The contributions of this paper include; the empirical evidence of the impactful challenges being faced in the mass adoption of blockchain which lacks in research (Caldarelli et al., 2021 ; Nath et al., 2022). Further, this study responds to the recent calls for more work on exploring the theoretical application of the technology adoption model, establishing grounds for

academics and practitioners about the influence of technology, organization, and environmental factors in an organization's technology adoption (Gupta et al., 2022). This paper also bridges the gap of unawareness about the real-world potential and constraints of BT by proposing an appropriate framework to overcome these adoption barriers (Lim, 2023; Toufaily et al., 2021). Therefore, the study poses the following research questions.

## 1.1 Research Questions

- What are the facilitators and barriers in the mass adoption of blockchain technology at organizational level?
- How contingent factors, if any, influence the process of blockchain adoption?

## 1.2 Research Objectives

- To explore the facilitators and barriers to mass adoption of blockchain technology at organizational level.
- To identify the contingent factors involved in mass adoption of blockchain technology.
- To explore the role of contingent factors in the process of blockchain adoption.

# Chapter 2: Literature Review and Theoretical Lens

## 2.1 Blockchain Technology Overview

The concept of blockchain was initially introduced as "Blocks of Chain" by Nakamoto in 2008 to elaborate the new peer-to-peer system of electronic currency – Bitcoins (Nakamoto, 2008). It forms a secure and decentralized network (Puthal et al., 2018) instead of conventional database which are linked to a centralized system. Each ledger in the system is responsible for keeping its records and transact directly with other ledgers or nodes (Hawlitschek et al., 2018) making a chain of cryptographic blocks (Lu, 2019) and verifies valid transactions only (Taylor et al., 2020). The technology allows agreements and transactions to be permanently stored on a common ledger accessible to all the blocks on the chain (Lacity, 2018).

The blockchain technology characteristics include disintermediation, traceability of assets, immutable, secure, transparent and time-stamped. Each transaction on the chain is stored with proper time and date without any chance of alteration, hence no party can deny or dispute their addition to the transaction, making the process streamlined and trustworthy (Drescher, 2017).These characteristics of the blockchain technology increased its potential applicability in many industries and sectors other than cryptocurrency like accounting and assurance(Coyne & McMickle, 2017), healthcare (Hölbl et al., 2018), forestry (He & Turner, 2021), agri-food sector (Antonucci et al., 2019), energy (Andoni et al., 2019), travel and tourism industry (Ozdemir et al., 2020), logistics and supply chain (Tijan et al., 2019), education (Alammary et al., 2019), insurance (Gatteschi et al., 2018), fashion etc. One of the most significant characters of BT is ensuring the traceability of products at all stages, tracking the process from raw material stage to commercialization stage. This revolution in supply chain management has increased brand's accountability and traceability, making the stakeholders (suppliers, manufacturers, retailers, customers) realize the importance of implementing blockchain in SCM (Cole et al.,2021; Tönnissen & Teuteberg, 2020). Hence, several industrial sectors like fashion(Agrawal et al., 2021) have taken the step to implement blockchain solutions in counterfeiting issues (Meraviglia, 2018) and increasing business efficiency, value (Lacity, 2018) and opportunities for growth.

## 2.2 Adoption of Blockchain:

BT is one of the significant IT innovations which holds the potential to disrupt and redesign the industrial structures (e.g. financial, legal, insurance, supply chain management, sharing economy, healthcare etc.) in the coming decade (Puschmann & Alt, 2019; Tapscott & Tapscott, 2018). IT innovations have become the ultimate strategy for business to innovate and influence the overall company in enhancing the performance, growth, efficiency, productivity and profitability (Barrett et al., 2015; Plewa et al., 2012; Christensen et al., 2015).

Recent studies have shown increasing interest of researchers examining various technological aspects of blockchain (Yli-Huumo et al., 2016), consensus mechanism and validation strategies (e.g., Proof-of-Stake and Proof-of-Work) (Cong & He, 2019), impact of the technology and its application in financial reporting and corporate governance (Yermack, 2017). Owing to the many benefits of the blockchain technology, governments, organizations and consumers are adopting the BT and Distributed-ledger technology, thus making it a hot topic for researchers (Farahani et al., 2021).

Many theories have been used to understand the technology adoption process in organizations and individual level such as technology acceptance model (TAM)(Davis, 1989), theory of planned behavior (TBP)(Ajzen, 1991), structuration theory (ST)(Bryant & Jary, 2014) , unified theory of acceptance and use of technology (UTAUT) (Araya-Schmidt et al., 2003), innovation theory, adaptive structuration theory (AST) (DeSanctis & Poole, 1994), diffusion of innovation theory (DOI) (Rogers, 1995), Technology-organization-environment theory (TOE) (Tornatzky et al., 1990), institutional theory, and some others. The most used models for adoption process are TAM, TBP, UTAUT at individual level. However, TOE is the most frequently used model for analyzing the technology adoption process at organization level (Molinillo & Japutra, 2017) which covers all the essential factors of technological, organizational and environmental aspects of adoption (Wong et al., 2020;Toufaily et al., 2021).

TOE framework is mainly used to elaborate the factors influencing the adoption of technology innovations at organization level in context of technology, organization and environment. The technology context covers the technological factors like privacy, security, relative advantage, complexity and compatibility which affects the current systems or newly considered IT innovations for adoption (Rogers, 1995). The organization context encompasses the internal organizational factors like top management support, size, prior IT experience, innovativeness,

organizational readiness and information intensity (Weiner, 2009). The environment context covers the factors which influence the operating activities of a business such as industry dynamics, competitive intelligence, market dynamics, government interactions, legal and social regulations (Lippert & Govindarajulu, 2006).

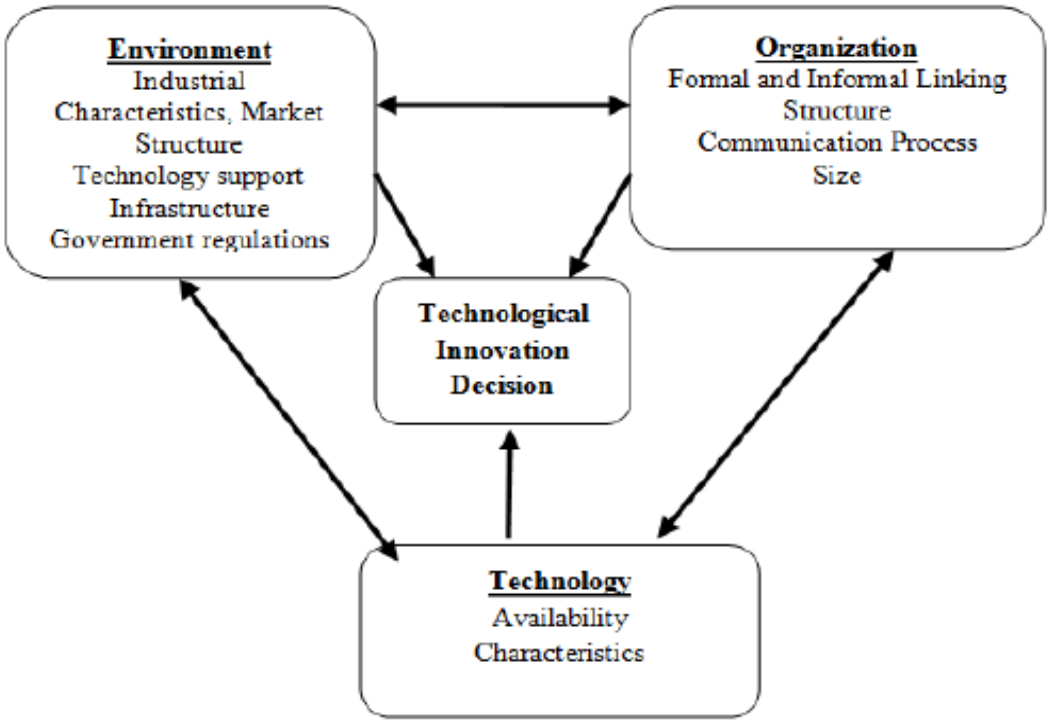


*Figure 1 TOE Framework* (Tornatzky et al., 1990)

Lihniash and colleagues (2019) has studied the adoption of Internet Financial Reporting (IFR) in financial institutions using TOE framework as the base model. (Martins et al., 2016) conducted a study to asses the determinants significant in diffusion of Software-as-a-service (SaaS) in organizations by this theoretical model. Adoption of Enterprise Resource Planning (ERP) software in SMEs using this theoretical framework have also been studied (Awa et al., 2016). (Sun et al., 2020) incorporated TOE framework to determine the significant factors in organizational adoption of Big Data. The adoption process of cloud computing in SMEs, with TOE framework as the theoretical base have been studied (Skafi et al., 2020).

This theoretical framework has been used by many researchers to study the adoption process of blockchain technology in various sectors. According to (Clohessy et al., 2019), the review

of 20 research articles focusing on TOE framework was done. The study extracted the significant factors influencing the BT adoption in organizations.

*Table 1 Summary of Significant Blockchain Adoption Factors*

| Technological factors | Organizational factors | Environmental factors |
|---|---|---|
| Perceived benefits | Organizational readiness | Regulatory environment |
| Complexity | Organizational size | Industry pressure |
| Data security | Top management support | Government support |
| Compatibility | Business model readiness | Market dynamics |
| Maturity | Innovativeness | Business use cases |
| Disintermediation | Technology readiness | Trading partner support |
| Smart contract coding | Blockchain knowledge | Critical user mass |
| Permissions (public vs private) | Innovativeness | |
| Architecture | | |

These factors act as drivers or barriers in the technology adoption process (Clohessy et al., 2019).

## 2.3 Facilitators and Barriers

### *2.3.1 Technological Factors:*

Even though the technology has much hype (Kouhizadeh et al., 2018), its mainstream adoption is still facing constraints such as data immutability, implementation cost, security risks, and privacy issues (Pournader et al., 2020;Ghode et al., 2019). In logistics and SCM, speed and scalability issues, technological access limitation (Saberi et al., 2019a), and privacy and security concerns prove to be the barriers in adoption (Yadav et al., 2020).

Toufaily and his colleagues concluded that data privacy (anonymity, confidentiality vs transparency) and security being a trust component in mostly public blockchains, is found to a driver in the adoption process. While it's a big concern for other sectors such as finance. The study also emphasized security as a challenge in terms of risks of fraud, data tempering, centralized control and lack of consensus mechanism in permissioned blockchain adoption.

Technical immaturity is also causing hindrance in mass adoption of the technology (Toufaily et al., 2021) due to its infancy and introductory stage of lifecycle (Wang et al., 2018).

Researchers have found the adoption cost of BT as long-term investment for some public sectors, favoring the efficiency of transactions, whereas for private sectors, the adoption and implementation cost is deemed to be a barrier (Toufaily et al., 2021). Wong et al. also statistically supported cost as a driver for BT adoption (Wong et al., 2020).

### *2.3.2 Organizational Factors:*

Despite enough potential use cases, the blockchain adoption is not rapid enough (Saberi et al., 2019a) due to factors like regulatory uncertainty, insufficient stakeholder awareness and ease-of-use and, high complexity of the system (Yadav et al., 2020). Studies have focused the shortage of blockchain-skilled technicians or specialists as a major barrier in BT adoption (Kurpjuweit et al., 2019), among other factors such as governance mechanisms, middle management participation and maintenance (Mougayar et al., 2016). Apart from the above mentioned factors, research has also pointed out business model alignment, leadership and organizational readiness (i.e. absorptive capacity, funding and skills) as the key influencing factors in the adoption of BT in organizations, lack of which would lead to insufficiency of human and finance capital resources and become a challenge in the adoption process (Toufaily et al., 2021).

According to Ghode et al., organizational challenges such as inter-organizational trust, relational governance and operational challenges such as interoperability and product type clouds the judgement in adopting BT in supply chains (Ghode et al., 2019).

### *2.3.3 Environmental Factors:*

TOE framework highlights the role of environmental factors, like infrastructure, government regulations and market dynamics, in influencing a company's decision of technology adoption. Some external environmental barriers in BT adoption includes regulatory uncertainty and ecosystem readiness (insufficient understanding, education and awareness by customers) (Toufaily et al., 2021).

Kouhizadeh and colleagues (2021) has referred environmental factors as internal and external. Practical implementation with managerial support and practices (Yadav et al., 2020) are the organizational internal environmental factors that might act as the drivers or barriers to the

adoption in SC (Saberi et al., 2019). Studies have explained the importance of transparency in supply chain, but mere adoption of the BT doesn't ensure the sustainability, managers also have to play a significant role in the company's policies and norms (Venkatesh et al., 2020).

External Barriers refers to the market and industry dynamics as well as the government support. Even though a large number of countries are adopting DLT and BT, governmental support is still considered scarce (Clohessy et al., 2019). Market uncertainty and slow acceptance of the technology has led managers to reconsider taking this investment risk (Mangla et al., 2018).

The TOE framework is helpful in elaboration of BT adoption process but still liable to the context of adoption. Researchers need to conduct the study on focused sectors, contexts and settings for better understanding of the adoption process (Toufaily et al., 2021).

# Chapter 3: Research Methodology

## 3.1 Research Paradigm:

Due to the limited empirical research conducted with regard to blockchain technology adoption, this study adopts the exploratory research approach. It is an efficient method to discover data, relationships, patterns, ideas and themes (Hair et al., 2020) The study adopts an interpretivist research paradigm with qualitative methodology to gather and analyze the data. In qualitative research, use of various sources of data is involved such as interviews, documents, and observations (Myers, 2020).

The primary aim of this research is to explore the intricate dynamics surrounding the adoption of blockchain technology in organizations. To accomplish this, a qualitative research strategy was meticulously chosen, focusing on semi-structured interviews conducted with a diverse cohort of participants, including blockchain developers, analysts, experts, and professionals from various companies.

Interpretivist research paradigm which is based on constructivist ontology and an interpretivist epistemology (meanings are constructed socially) in business and management disciplines is adopted (Rashid et al., 2019). As the study is using template analysis for the data analysis, "social constructivist" position is used which is based on the assumption that there happen to be multiple interpretations for any phenomenon, which depends on the researcher and the research context (Madill et al., 2000).

## 3.3 Research Approach:

Inductive research approach is adopted in the study which involves the data-driven strategy. It starts with the respondents' experiences and data obtained and as a result theory is developed. The research moves along according to the observed themes and patterns in data, inducing explanations to generalize the developed theories (Creswell, 2014).

## 3.4 Participants

The initial phase of participant recruitment involved an extensive outreach campaign targeting over 300 blockchain technology experts and analysts via email and LinkedIn. The criteria for selecting these professionals were 1. Blockchain developers, 2. Blockchain experts and

Analysts, 3. Blockchain Users. Blockchain developers are those who are involved in developing the blockchain for organizations according to their needs. Blockchain Analysts and experts are the professionals who have market analysis and adoption expertise for adoption in organizations. Blockchain users are those who are involved in the adoption of blockchain in organizations. Regrettably, a substantial portion of these communications found their way into spam folders or experienced bounce-backs, as indicated in the research of Bell and Bryman (2022). This unexpected hurdle prompted a flexible, adaptive approach, a common occurrence in qualitative research.

Convenience sampling, as described by Bell (2022), is a non-probability sampling method wherein participants are chosen based on their ease of access and availability. This approach acknowledges the pragmatic considerations of research. Snowball sampling, as proposed by Biernacki & Waldorf (1981), is another non-probability sampling technique where initial participants are chosen deliberately, and they, in turn, refer the researcher to other potential participants. This method is particularly useful when access to a specific population is challenging.

The ensuing strategy, combining elements of convenience and snowball sampling methods, as advocated by (Patton, 2005), led to constructive connections with blockchain experts, analysts, and developers who demonstrated a genuine interest in contributing to the research through online interviews. The study includes 26 participants in total who are blockchain developers, analysts or experts working in various firms. It also has top management and analysts from the firms which have adopted blockchain. The participants selected are either working as third-party blockchain solution providers or have adopted the technology itself. To maintain the confidentiality of the respondents and keep them anonymous, all interviewees were given pseudonyms from the alphabet A-Z. For example, Respondent 13 was given the pseudonym of *"Respondent M".* The position of the respondents in the organization or their independent occupation is given along with years of experience in the table.

*Table 2 Details of Participants*

| Participants | Position | Based in | Experience in BT |
|---|---|---|---|
| Respondent A | Blockchain Engineer Manager | US | 6 Years |
| Respondent B | Head of Blockchain Dept | Singapore | 5 Years |
| Respondent C | Senior Blockchain Developer | Pakistan/US | 3.5 Years |
| Respondent D | Blockchain Researcher | Pakistan | 6 Years |
| Respondent E | Software Engineer in blockchain development | UK | 3 Years |
| Respondent F | Managing Director | Pakistan | 5 Years |
| Respondent G | Opensource Developer/Freelance Blockchain Developer | Pakistan | 3 Years |
| Respondent H | Blockchain Developer/freelancer | Pakistan | 3 Years |
| Respondent I | Blockchain Analyst | Pakistan | 3.5 Years |
| Respondent J | Blockchain Analyst/Digital Incubator | US/UK | 5 Years |
| Respondent K | Blockchain Expert/ Cofounder | UK | 5 Years |
| Respondent L | Blockchain Analyst | Pakistan | 10 Years |
| Respondent M | Core Runtime developer for blockchain | Switzerland | 5 Years |
| Respondent N | Blockchain Developer/freelancer | Scotland | 4 Years |
| Respondent O | Core blockchain developer | Pakistan | 5 Years |
| Respondent P | Innovation Manager | Pakistan | 10 Years |
| Respondent Q | Blockchain Expert | Singapore | 3.5 Years |
| Respondent R | Senior Development Engineer | US/UK | 2.5 Years |
| Respondent S | Blockchain Researcher | Australia/Pakistan | 10 Years |
| Respondent T | Blockchain Researcher | Pakistan | 4 Years |
| Respondent U | Managing Director | Australia/US | 5 Years |
| Respondent V | NFT Developer | Pakistan | 3 Years |
| Respondent W | Innovation Manager | UK | 5 Years |
| Respondent X | Technology Innovation Specialist | UK | 5 Years |
| Respondent Y | Product Head | UK | 10 Years |
| Respondent Z | Blockchain Analyst/Expert | EU/UK | 12 Years |

## 3.5 Data Collection Process

### *3.5.1 Data Collection Instrument:*

For this qualitative research study, data collection was primarily conducted through semi-structured interviews. Semi-structured interviews are a widely accepted method for collecting in-depth qualitative data (Noble & Smith, 2015). This approach allows for flexibility while ensuring that the research objectives are met by guiding participants through a set of predetermined questions, as well as permitting open-ended responses to gather a comprehensive understanding of the research topic (Bell et al., 2022). This method is particularly suitable for qualitative research, as it permits a deep understanding of the participants' experiences and perspectives.

The data collection process consisted of two distinct parts. The first part involved gathering demographic information from the participants, which included details such as age, gender, educational background, current job position, and years of experience in both their current roles and the industry. This demographic information was collected to provide context and a broad understanding of the participants involved (Creswell, 2014).

The second part of the interview involved questions related to the research study, which were designed in alignment with the TOE (Technology, Organization, Environment) framework. This framework provided a structured basis for exploring the impact of technology adoption in organization (Tornatzky et al., 1990).

The interview questions were designed to extract in-depth responses about participants' experiences, perspectives, and observations regarding technology adoption in organization. Open-ended questions encouraged participants to provide detailed insights, personal anecdotes, and real-world examples, facilitating a rich understanding of the subject matter (Patton, 2005).

Prior to the commencement of each interview, explicit consent was obtained from all participants, emphasizing their voluntary participation and the recording of these sessions for in-depth analysis, as per the suggestions of Flick (2017).

As supported by Guest, Namey, and Mitchell (2013), saturation of rich data was the guiding principle, signaling the point at which no new information or themes emerged from subsequent interviews. This is a common practice in qualitative research, signifying a logical endpoint for data collection, as outlined in the works of Saunders, Lewis, and Thornhill (2009). In this study,

the data saturation point was achieved after 20 interviews. However, a total of 26 participants were included representing various firms. Template Analysis style of study can be used for efficiently for this research, as its appropriate for a single autobiographical case to large qualitative studies of up to 80 interviews (Symon & Cassell, 2012).

### *3.5.2 Pilot Testing:*

Before diving into the main data collection phase of this research, pilot testing was conducted. The aim of this pilot testing was to fine-tune our research methods and materials. We engaged with five individuals who are experienced in blockchain development, experts, and service providers. The insights gained from the pilot interviews were instrumental in enhancing the quality and effectiveness of our data collection process. During the pilot interviews, it became evident that some of the technical language and terminologies used in the initial questionnaire were too complex for individuals with IT backgrounds. The pilot interviews allowed us to identify and rectify this issue by simplifying the language. This adjustment ensures that the questions are more understandable and accessible to the target participants, facilitating a more fruitful data collection process.

Pilot interviews also revealed that additional probing questions were necessary to encourage participants to provide more detailed and insightful responses. These probing questions were designed to dig deeper into the participants' experiences and perspectives, allowing for a richer understanding of the subject matter.

## 3.6 Data Analysis:

Template analysis which is one of the widely used method of thematic analysis in qualitative research, is used to evaluate the data. It offers a clear, systematic approach to data analysis. The flexibility of the coding structure helped the researcher to easily grasp the richest aspects of data in depth.

Template analysis is positioned in the middle ground between bottom up and top-down analysis styles. The researcher defines some themes in advances mostly called as *"a priori themes"* in the development of the template. But they can be redefined and discarded according to the requirement of the recurring themes and codes in the analyses, which develops appropriate new themes. (Brooks et al., 2015; King, 2017).

### *3.6.1 Initial Template*

1. **Technological Factors**
   - 1.1 Facilitators
     - 1.1.1 Confidentiality and Anonymity
     - 1.1.2 Disintermediation and security
     - 1.1.3 Transparency
   - 1.2 Barriers
     - 1.2.1 Data Immutability
     - 1.2.2 Security risks and privacy concerns
2. **Organizational Factors**
   - 2.1 Facilitators
     - 2.1.1 Organizational Readiness
     - 2.1.2 Business Model Alignment
   - 2.2 Barriers
     - 2.2.1 Lack of Experts
     - 2.2.2 Unawareness about Blockchain
     - 2.2.3 Operational Challenges of interoperability
3. **Environmental Factors**
   - 3.1 Facilitators
     - 3.1.1 Industry Pressure
     - 3.1.2 Trading Partner Readiness
   - 3.2 Barriers
     - 3.2.1 Regulatory Uncertainty
     - 3.2.2 Issue of Ecosystem readiness (insufficient understanding and education about BT)
     - 3.2.3 Market Uncertainty
4. **Potential Applications and Use cases**
   - 4.1 Facilitators
     - 4.1.1 Digital Currency
     - 4.1.2 Non-fungible tokens (NFTs)
     - 4.1.3 Digital Assets and collectibles

The initial template was taken from theoretical lens which helped in creating structure in the initial phase of data analyses, taking a top-down approach in analysis, named as technological factors, organizational factors and environmental factors. The technique then uses the bottom-up analysis style in constructing the themes based on the recurring codes and data structure. According to Brooks, King and Symon (2015; 2012), following are the steps followed in template analysis:

1. The researcher familiarized with the dataset by reading the transcripts for better understanding.
2. Preliminary coding of the data was done by highlighting the recurring concepts in the texts which contributed towards the researcher's understanding. This step is similar to the thematic analysis but in Template Analysis, a priori themes were generated to start analysis with guidance of the theoretical lens. These tentative themes helped in structuring the data and classified it for a detailed analysis. However, these categories were kept tentative and open-minded approach was kept for the emerging themes which did not fit in the preliminary template.
3. The next step was to organize the data and categorize them into meaningful clusters. Four major clusters were created to arrange the data such as technological factors, organizational factors, environmental factors, and potential applications or use cases of blockchain. Narrower themes were constructed in these broader ones according to the data.
4. At this point, the initial template was clear taken out of the literature and pilot interviews. The hierarchical arrangement of the data structure was also prominent. All the data was further sub-categorized into barriers and facilitators of blockchain adoption, the third cluster was for the factors having a dual role according to the context. The researcher named these factors as "contingent factors", during the adjustment of template.
5. The initial template was adjusted applied to the rest of the data and modified where necessary. The researcher adopted the bottom-up approach in constructing the themes of recurring concepts such as management support, resource support by the managers, and leadership into the theme "Role of management and resource support". This theme was put into the preliminary category of organizational factors. At this point, it was made clear that the category of "potential applications and use cases of blockchain' must not be a major dimension or category. Rather, it is emerging as a theme in

technological factors. So, the iterative process of organizing the template helped in analysing the data in depth, making sure to not leave any relevant data to the research questions uncoded.

6. The final template was applied to the full data set. But the researcher kept refining it for better analysis. At this point, the initial concepts were categorized into “barriers, facilitators and contingent factors” which were separated into the emerged broader themes later on to be classified into the initial template dimensions. This template efficiently answered the research questions and interpreted the data for the report.

### *3.6.2 Final Template*

1. **Technological Factors**
    - 1.1 Potential Applications & Use cases
        - 1.1.1 Facilitators
            - 1.1.1.1 Digital Currency and payments
            - 1.1.1.2 NFTs and Digital Collectibles
            - 1.1.1.3 Customer Engagement
            - 1.1.1.4 Decentralized Autonomous Organizations (DAO)
    - 1.2 Technical Characteristics
        - 1.2.1 Facilitators
            - 1.2.1.1 Traceability and Immutability
            - 1.2.1.2 Decentralization
        - 1.2.2 Barriers
            - 1.2.2.1 Scalability and Volatility
            - 1.2.2.2 Complexity
        - 1.2.3 Contingent Role
            - 1.2.3.1 Transparency
            - 1.2.3.2 Financial Disintermediation
2. **Organizational Factors**
    - 2.1 Financial Matters
        - 2.1.1 Facilitators
            - 2.1.1.1 Improved Revenue Generation
        - 2.1.2 Barriers
            - 2.1.2.1 Implied Cost of Human Resources
            - 2.1.2.2 Investment Risk
        - 2.1.3 Contingent Role
            - 2.1.3.1 Issue of High Transaction Cost
    - 2.2 Role of Management and Resource Support
        - 2.2.1 Facilitators
            - 2.2.1.1 Management support in resources
            - 2.2.1.2 Increased productivity in system

2.2.2 Barriers
2.2.2.1 Lack of Knowledge
2.2.2.2 Lack of Experts
2.2.3 Contingent Role
2.2.3.1 Role of Management and CTO
2.2.3.2 Autonomy and Leadership

**3. Environmental Factors**

3.1 Associated Risks
3.1.1 Barriers
3.1.1.1 Money Laundering and Terror Financing
3.1.1.2 Scams and Tax Evasion
3.1.1.3 Security and Privacy concerns

3.2 Institutional Factors
3.2.1 Barriers
3.2.1.1 Change in Infrastructure
3.2.1.2 Lack of Standardization and Trust
3.2.2 Contingent Role
3.2.2.1 Role of Government
3.2.2.2 Business Compatibility

3.3 Competitive Landscape
3.3.1 Contingent Role
3.3.1.1 Competitive Intensity and Advantage
3.3.1.2 Trading Partner Readiness
3.3.1.3 Effect of Buzzword of Blockchain

*Table 3 Data Structure*

| First Order Concepts | Second Order Themes | Third Order Dimensions |
|---|---|---|
| **Facilitators**<br>Digital Currency and payments<br>NFTs and Digital Collectibles<br>Customer Engagement<br>Decentralized Autonomous Organizations (DAO) | Potential Applications & Use cases | **Technological Factors** |
| **Facilitators**<br>Traceability & Immutability<br>Decentralization<br>**Barriers**<br>Scalability and Volatility<br>Complexity<br>**Contingent Role**<br>Transparency<br>Financial Disintermediation | Technical Characteristics | |
| **Facilitators**<br>Improved Revenue Generation<br>**Barriers**<br>Implied Cost of Human Resources<br>Investment Risk<br>**Contingent Role**<br>Issue of Transaction cost | Financial Matters | **Organizational Factors** |
| **Facilitators**<br>Management Support in Resources<br>Increased Productivity in System<br>**Barriers**<br>Lack of Knowledge<br>Lack of Experts<br>**Contingent Role**<br>Role of Management and CTO<br>Autonomy and Leadership | Role of Management and Resource Support | |
| **Barriers**<br>Money laundering & Terror financing<br>Scams & Tax Evasion<br>Security and Privacy concerns | Associated Risks | **Environmental Factors** |
| **Barriers**<br>Change in Infrastructure<br>Lack of Standardization & Trust<br>**Contingent Role**<br>Role of Government<br>Business Compatibility | Institutional Factors | |
| **Contingent Role**<br>Competitive Intensity & Advantage<br>Trading Partner Readiness<br>Effect of Buzzword | Competitive Landscape | |

## 3.7 Ensuring Research Quality

The quality and trustworthiness of a research study are pivotal in maintaining the rigour and reliability of its findings. In the context of this investigation into blockchain technology adoption, several measures have been undertaken to improve the credibility and validity of the research.

### *3.7.1 Credibility*

*Credibility* pertains to the extent to which the research findings are believable and can be trusted. The following steps have been employed to enhance the credibility of this study:

- **Member Checking**: In line with Lincoln and Guba's (Guba, 1981) recommendation, participants were offered the opportunity to review and confirm the accuracy of the transcriptions and interpretations of their interviews. This member-checking process serves to validate the alignment of the findings with participants' perspectives.
- **Prolonged Engagement**: Engaging with the research context over an extended period has allowed the researcher to develop a deeper understanding of the subject matter and build rapport with participants. This extended involvement is in accordance with Lincoln and Guba's concept of prolonged engagement, which enhances the researcher's insight into the research context.

### *3.7.2 Transferability*

*Transferability* concerns the extent to which the research findings can be applied to similar contexts or populations. To enhance the transferability of this study:

- **Rich Description**: The research includes rich, thick descriptions of the research context, participants, and data analysis. These detailed descriptions, as suggested by Younas and colleagues (2023), will enable readers to evaluate the applicability of the findings to other situations.

### *3.7.3 Dependability*

*Dependability* is concerned with the stability and consistency of the research findings over time. The following strategies have been implemented to enhance dependability:

- **Audit Trail**: An audit trail, as advocated by Guba and Lincoln (1989), has been maintained, documenting the research process, data collection, and data analysis. This trail serves as a transparent record, allowing for the verification of the research procedures and decisions made.

### *3.7.4 Confirmability*

*Confirmability* refers to the degree to which the research findings are shaped by the participants' perspectives rather than the researcher's biases. To ensure confirmability:

- **Reflexivity**: The researcher has maintained a reflexive journal, as recommended by Finlay (2008), to record personal thoughts, biases, and reflections throughout the research process. It allowed the researcher to engage and relate with the respondents to gather important information in depth with more sophisticated jargons. This improved the quality of data and its veracity. However, the biasness was kept in check with help of the journal and cross-checking the transcriptions after each interview for researcher's biased comments. This process also helped in restructuring the questions in a more natural tone for achieving the raw and unbiased outcomes.

These measures collectively contribute to the credibility, transferability, dependability, and confirmability of the research findings, bolstering the overall quality and trustworthiness of this study.

## 3.8 Ethical Considerations

An essential part of this research was the strict adherence to ethical principles, which was crucial for protecting the rights and well-being of participants and ensuring the integrity of the study. The ethical considerations in this research included the following elements:

**Informed Consent:** Prior to their involvement in the research, a formal letter of permission and informed consent forms were sent to all prospective participants. This communication explicitly articulated the research's purpose, objectives, and procedures, ensuring that participants fully understood the nature of their involvement. Written consent was obtained from all participants to confirm their willingness to participate.

**Transparency:** Throughout the research process, the intentions of the study and the expectations of participants were communicated clearly and transparently. This commitment to openness prevented any form of deception or misunderstanding at any stage of the research.

**Confidentiality and Privacy:** The research team was dedicated to safeguarding the confidentiality and privacy of all participating firms, ensuring the protection of sensitive business data and preventing the disclosure of any current or future business strategies.

**Anonymity:** All firms participating in this research were kept anonymous unless they explicitly granted permission to reveal their identities. This approach protected the interests of the participating firms while facilitating open and honest participation in the study.

**Voluntary Participation and Withdrawal:** Interviewees were provided with the option to discontinue their participation in the research at any time, without the need to provide a specific reason. This voluntary participation and withdrawal process ensured that participants had the freedom to make their own choices throughout the research.

By adhering to these ethical considerations, this research maintained the highest standards of research ethics, fostering trust and cooperation among all participants, while protecting their rights and ensuring the validity of the research outcomes.

# Chapter 4: Findings

The analysis of the semi-structured interviews identified the main themes such as: technical characteristics, institutional factors, associated risks, competitive landscape, finances and lastly support and role of the management. These themes are explained by the factors which are playing the role of barrier or facilitator or dual nature according to the context. For example, government support is both a facilitator and a barrier according to each country's policies.

## 4.1 Technological Factors:

### *4.1.1 Technical Characteristics:*

These are the factors which are mainly the characteristics of blockchain which are playing a role in the adoption and implementation of the technology. The break-through features like transparency, immutability, disintermediation etc. are all playing a decisive role as a barrier and a facilitator in the adoption process. The interviewees have elaborated on different contexts in which the features are playing a dual role according to the nature of blockchain i.e. either permissioned or permissionless, where necessary.

Transparency is the revolutionary feature of the technology, as it brings accountability in the system (Malik et al., 2021). Organizations are able to control and manage their data and operations, acting as a facilitator in supply chain management, and creating traceability. Like the respondent said:

> *"Information transparency on the blockchain is inevitable because of its immutability. One of the biggest examples of this is the fact that the first pizza that was bought by using cryptocurrencies and Bitcoin in particular, it's still there like you can go and check the first transaction that happened or the first commercial transaction to happen on the Bitcoin network. Again, any transaction that happens on the blockchain is either on a public Ledger or a private one, the owners or the stakeholders are able to view that and make decisions accordingly. So yes, there is transparency and I think people do want transparency". (Respondent L)*

But that is one side of the story. Our interviewees think that no matter how synchronized the operations of an organization are, it's still hesitant to insert this level of transparency in the system. As it has various privacy concerns for organizations as well as the users. They fear

their data and personal information can be stolen through this and can be misused. A respondent explaining transparency as a barrier said:

> *"The big giants are just gathering the information and data of users without their will and if they put it up on the blockchain then people would see their personal data being stolen. And those giants are not willing to jeopardize it". (Respondent F)*

However, it has an amorphous nature to it. The feature can act as a facilitator when used with a positive intention in the betterment of the system. But the negative side of it is alarming to the extent of making it a barrier. A respondent said:

> *"So, in the healthcare industry, data privacy is a huge concern. While they were shifting the data on blockchain, a huge barrier that they were facing how they're going to, you know, stop people from accessing the user data. And if someone wants to see their data, how they can facilitate that thing. Transparency and knowing each detail is a good thing, but also a barrier itself". (Respondent H)*

Some of the other factors that have a contingent nature and act according to the context are disintermediation, transaction cost and immutability. Disintermediation can be seen as data or information and financial matters. In terms of financial intermediary, this is a major barrier due to the loss of control by the financial entities like the government and the banking sector *"The banks are going to create big barriers so that they are not cut out and have the monopoly. They do not allow its adoption because otherwise it will just become completely different environment where they are very powerless" (Respondent W)* given that they provide assurance and credibility about businesses and holds accountable for payments and trade.

But at the same time, financial disintermediation is also considered as a facilitator in the adoption process, because businesses are frustrated of the governmental control on the traditional currency system and blockchain offers its digital currency which can be controlled by the businesses without intermediation of banking system or government (Z. J. Zhang, 2023). Similarly, disintermediation in terms of information and system management is also contingent factor. Some interviewees consider it to be a barrier but others having experience greater than 6 years in the domain mark it as a facilitator due to centralized system and uninterrupted flow of information for all stakeholders.

Compatibility of blockchain with the current business and technological system is also a question mark for many experts. According to the data, organizations are very much satisfied

with their current business systems and operations running smoothly that they question the utility of the technology.

*"As you know, Walmart has shifted their whole supply chain on blockchain. They have collaborated with IBM and shifted their whole supply chain on blockchain. So that was one initiative that I saw from such a huge organization. But we see other organizations and different institutions who are not shifting towards blockchain because there is no need right now and their systems are working perfectly." (Respondent H)*

But the compatibility of BT with the existing systems is complicated. An interviewee explained the process to be of complex and disturbing for organizations.

*"it's not easy to replace it because it just requires so many changes at so many different levels and all the stake stakeholders involved like policymakers, businesses, customers and other industries are all affected by it. I think it just would be easier if there was a way to plug it into an existing system without disturbing it. And that happens when there is like a slower incremental change, and it is just not easy to do it with this technology." (Respondent W)*

Instead, many respondents whose blockchain experience counts to more than 5 years, think that it as highly compatible with the system and easily transferable from conventional to new upgraded blockchain technology, thus making it a facilitator.

*"It fits well with the business processes, technology and the technological infrastructure. What blockchain does is basically adds a layer of security and robustness on top of the current technological infrastructure of any company." (Respondent L)*

The technical factors are playing a decisive role for the technology adoption to be a barrier to itself or act as a facilitator in the process. It is impediment to learn about the technology to add value to our process and gain from it. It is useless to see these technical factors as harmful to the business instead of using them in a way to profit from the technology.

### *4.1.2 Potential Applications and Use cases:*

The promising technology offers countless potential applications of which are industry-specific while some are apt for every business. Decentralization is one of the prominent feature and application of blockchain. Distributed-ledger technology works on nodes along the chain which ensures immutability. It also allows all the stakeholders to have a consensus mechanism for the introduction of new processes. Like a respondent commented on the important application of consensus mechanism through blockchain:

*When two or more partners are on the chain, it forms a consortium. Everyone will be able to see the data. And there is a voting facility as well and you can vote on certain factors or for new implementations. (Respondent Q)*

Decentralized Apps (DApps) and Decentralized Autonomous Organizations (DAO) are also significant applications. Blockchain service providers are creating and optimizing DApps for businesses according to their specific business models. DAO is being explored by various technologists and researchers for promoting transparency and consensus in organizations. This rightfully untapped potential application of blockchain seems to have great value according to our respondents.

*"Autonomous organization like a so-called DAO would be an interesting organization form to adopt because it essentially has the idea of spreading decision making power within the organization based on governance tone. That has a huge innovation potential in industry" (Respondent Z)*

Other beneficial applications of the technology include automation, supply chain management, industry-specific solutions to problems like counterfeiting, transparency in e-voting and more.

*There are some accounting firm or manufacturing firm who suffers from the fact that there are a lot of counterfeit products and, since they are not getting the revenue from them, they want to reduce that. Blockchain technology is a natural solution for them, right? (Respondent L)*

Another respondent when talking about supply chain management by blockchain said:

*"One of the major reasons why adopting blockchain in supply chain is the best thing you can do. If you have global supply chain, with a huge list of vendors, and multiple stages then bringing all of that process on blockchain would be very beneficial for you. Because at each step you can record and see what's happening. Who is already paid and who do you still have to pay". (Respondent H)*

*"We had a couple of other brands on board as well, so that was mainly designed to reduce the carbon emission of the production goods, and they wanted to use blockchain for that. (Respondent B)*

Blockchain multiplies the revenue generation through improved customer engagement by providing traceability about the entire production line, ensuring digital ownership and authenticity of the products. These customer-oriented applications are maximizing the profits for businesses.

*"The ownership of the goods itself is very efficiently managed by blockchain itself. This is a facilitator for most of the organizations particularly luxury industry". (Respondent C)*

## 4.2 Organizational Factors

### *4.2.1 Role of Management and Resource Support:*

At organization level, the adoption of technology is at the sake of management's role and support. Any innovative technological change is either technology pushed or pulled, it could come from the employee demand or when the management implement digital transformation for improved systems. They provide support in resources like funds, learning environment, autonomy and other training opportunities for the employees to educate and grow.

Blockchain technology has been there for almost two decades now, but its mass adoption is still considered a challenge for not only the smaller firms but also the bigger players in the market. One of the important factors found in the slow adoption is the lack of awareness or knowledge by the stakeholders such as general management, IT experts, business partners etc. As it is a complex technology even for IT experts, poor awareness and understanding by the management is not surprising.

> *"There is a lack of knowledge or awareness about the technology, because I'm not sure if people in, you know the fashion industry are like up to date with what's happening technologically. Especially when we talk about Pakistan, I mean if you just ask them if they know what blockchain is and how it can transform their business, I'm not sure how many of them would have heard about that term. So, it to be lack of awareness". (Respondent D)*

Being the decision makers of the business, top management in the big firms are usually older generation who are naturally reluctant to change and innovative technologies as it changes their dominant logic of the business system. As a respondent said:

> *"Right now, the higher management in most of the enterprises is always elderly people who are a bit resistant to the new changes, but they are slowly shifting towards adding innovation in their systems or infrastructure". (Respondent H)*

Thus, making it impossible for employees to avail themselves of the resources to innovate. Another respondent, when asked about the top management support, said:

*"The major thing I have seen in organizations is that management in their forties and above are not very accepting or open-minded about new stuff and technologies. However, the newer generation in management like they are passionate risk-takers. They believe the more you take risk, the higher reward you get". (Respondent I)*

But the young minds are seen to be risk-takers whether having their businesses or startups or influential roles in more prominent firms where they are given autonomy to make decisions. They believe to get more rewards, the more significant risk you take.

However, the demand for technology adoption might be due to the hype or the buzzword of blockchain in the market, which is forcing the management to take advantage of its potentials. Jumping on the bandwagon due to the fear of losing edge over the competitors. One interviewee explained this phenomenon as:

*"There is very poor or no technical understanding of blockchain. Now, this could be a facilitator, but also a barrier. There is a lot of hype for blockchain. So, people try to fit blockchain in ways that are not supposed to be used. There is some technology fetishisation to use it even if the top management generally does not know".*
(*Respondent S)*

In organizations, higher management relies on the Chief Technology Officer (CTO) and IT people to be informed and bring technological innovation. The role of CTO is very integral in the adoption of blockchain as he needs to be the first person to educate himself about BT. Due to slow development of the technology, there is not much he can do as his own learning is sluggish. Thus, he can act as a contingent factor, either as the facilitator or as the barrier of BT adoption.

According to an interviewee, the CTO or IT personnel's role, his power to make decisions and his respect in the firms is important. He said:

*"The presenter (CTO) uses extremely technical language, and even today, you know, we people who know blockchain, we talked about distributed ledgers, proof of work or whatever, and we just assume that everybody sitting in the boardroom, understand what we're talking about, but they don't understand anything. So, the decisions are made normally, the barrier or the facilitator would be the person is standing and presenting the business case. How well they are respected in that group. And if other people don't understand it. He can say "Trust me, I know what I'm talking about". And they going to say "Alright, if you want do it, do it"". (Respondent J)*

If the CTO succeeds in convincing the higher management about the potentials of the blockchain illustrating the beneficial use cases for the business then his role as a facilitator cannot be neglected. Like a respondent said:

> *"You know there is an R&D aspect like you know they have to research on how can adoption, I mean a lot of companies try to use the buzzword but at the end of the day for the adoption of blockchain to accelerate, it needs to be adopted the right way, right. And the people who are adopting blockchain in their organizations, they need to produce enough organizational value for the either the people inside the organization or you know, value to the users. Which will ultimately, you know, help accelerate the adoption" (Respondent K)*

Another respondent commented about the experience of a CTO generally compared to the one in blockchain domain. He said:

*"He has to be able to communicate so well with the business team to tell them why this thing happened and how much time it will take and what sort of issues there are, and he should be able to give a cushion to their developers like he should be able to understand. But, getting a senior CTO with the technology that was released five or four years ago or six years ago is very difficult right now because the CTO in general have 25 to 30 years of experience. But right now, we are getting CTO's who have five to six years of experience because it is the struggle of the industry in blockchain side that we cannot get a 20-year-old experienced guy as a CTO". (Respondent E)*

The lack of experts in the field either due to poor availability of the resources or complexity of the technology is a massive barrier. If the organizations are unable to fund the training and learning of its employees, then they need to hire external experts which cost them a lot too. But the problem still lies in form of lack of experts and analysts in the market.

> *"So, most of the people who are interested in that space and they don't know what blockchain itself is and what the technology brings on the table, but on the other hand, if you talk about technical organizations, if you talk about people who have some technical background who are interested in the technology itself, so the percentage is small". (Respondent J)*

This complex nature of the technology has become an enemy of its own adoption. However, some respondents think that there are ample learning resources for the technology but others

view these resources as inaccessible. But the organizations who are leaning towards innovation and advancement, are supporting the adoption of emerging technologies. They are experimenting with blockchain at pilot projects level.

Organizational innovativeness is a factor which promotes the learning, training, innovative culture among the employees and provides them with necessary resources to educate themselves and implement the emerging technology. Blockchain experts and analysts believes that not all organizations whether big or small have this characteristic but it's a necessary mean to adopt the technology. Innovative management who are keen to make pace with the world and motivate their employees.

*"Having a proper R&D department that keeps working on the new innovative technology existing in the market and schedule technical workshops with the HR for the all employees to train and educate them is the ultimate need". (Respondent A)*

> *"We have a polling system in our organization to choose a new innovative technology by the employees. So, the top management support us by getting the needful resources for that particular innovative technology and conduct different technical workshops by an expert trainer for us". (Respondent A)*

But change is something which is almost never accepted easily. It is by nature resisted especially by older aged management who are contented with their current systems. Thus, they are hesitant to organizational innovativeness. Our respondents have associated organizational innovativeness and support with the autonomy and trust in its employees (Caldarelli et al., 2021a; Malik et al., 2021). The management and leadership plays a dual role in the adoption process. This contingent factor when supports the innovative and learning of employees becomes the facilitators, whereas when they become reluctant on the adopting disruptive technologies, they act as barriers. The amount of room they are given to experiment and explore the technology directly results in their resilience towards disruption. The autonomous leadership is found to be a salient feature in the growth of employees. As the respondent said:

> *"I think the most crucial thing at an organization is the empowerment and trust given to us by our most senior leadership which actually drives the innovation in what we do" (Respondent P)*

Organizations have to incentivize the employees and come up with ample resources in terms of funding, training, learning courses to promote technological advancement. Employees have

to be trained and allowed to carry out pilot projects for better learning about the emerging technologies.

> *"Financing and the budget part can become a hurdle in terms of launching new initiatives. For example, if there's something which requires a budget, and so that can sometimes become a hurdle in the launch of new programs, unless you get a sponsor on board. You can get most things done with empowerment, but finance can still be a barrier.*
> *(Respondent P)*

The issue of finance support for digital transformation and capacity building is a problem for small as well as large businesses. Although, those who invest in the technology are profiting from its applications.

Given the potentials of blockchain, its digital assets and currency are main applications for the organizations to generate revenue. Many organizations have introduced the digital currency as a payment method for the purchase of physical and digital assets like Inditex (Zara). Others have introduced their own digital wearables in form of NFTs (non-fungible tokens) as revenue streams.

> *"Most of the companies now are actually coming into the blockchain chapter because of the NFT. They are not actually shifting their operations right onto the blockchain like Nike and Disney. They are just trying to create extra money". (Respondent G)*

The management support is extremely significant for blockchain adoption at organizational level. The management needs to create interactive learning environment for the employees to ensure their growth and sustainability against the digital disruption. This support can be in form of resources, funds, autonomous leadership and doing the needful for the stakeholders.

### *4.2.2 Financial Matters:*

Exploring, experimenting and exploiting a technology does not come cheap. Funds and heavy investments are needed even to carry out pilot projects. Thousands of dollars are spent just to do sandbox experiments to understand the phenomenon of the technology. Various finances either in the organizational capacity or technical one, are discussed here which plays a role in blockchain adoption whether as a barrier or as a facilitator.

By understanding the promising and potential applications of the technology, can the organizations feel comfortable in investing this technology. Many respondents talked about the

revenue generation and the exemplary financial returns of big established firms through the technology which acts a facilitator for others in investing.

> *"For most of the organizations including the fashion industry particularly, ownership of the goods, NFTs and stuff like that are very efficiently managed by blockchain itself. Hence, it's a good facilitator for them". (Respondent C)*

while smaller firms are still reluctant to see the extreme volatility and scalability issues being faced by the adopters. They are still hesitant to take this huge investment risk while adopting the 'wait and watch' strategy.

> *"If a company decides that they're going to do blockchain development, they need to pay the developers extremely high compensation packages. They need to make sure that they hire the right people, that they're working on the right technology, that the technology is scalable. As the cost of the investment and doing that R&D is also very high and that's like a barrier and unless there are more people doing it and more people moving to the blockchain landscape that unless their price comes down, you know very few companies will actually adopt". (Respondent K)*

However, the investment risk is huge as there is insufficient knowledge about the technology and lack of trust questions value addition in the system. As, most of the non-technological related sector outsource their IT operations to third party companies, they need to be extra vigilant in doing the cost and benefit analysis of the adoption.

> *"But when it comes to adopting at the corporate level, that's a serious investment. So, I need to understand the risk which is very hard to assess and that becomes difficult if the project is run by the technology people and not the business people who have poor knowledge about the blockchain value". (Respondent J)*

Transaction cost is another important contingent factor. The respondents are considering this feature to be context-based of private or public blockchains. The fast transactions with financial transparency and extremely cheaper transaction cost are acting as a game changer.

> *"That's a costly thing because for every transaction you do for making the transparency, you have to pay. But for organization it doesn't make any sense to get your work up on a public blockchain for an organizational stuff, it should be on a private chain which has no transaction cost or gas fee". (Respondent A)*

Here the respondent talks about zero transaction fee in a permissioned(private) blockchain. According to him, an organization should adopt private blockchain to run the system efficiently and keep its operations smooth. The fashion firms are mostly using it for interoperability and supply chain management; hence they use a permissioned blockchain to stay connected and trace all the functions (Choi, 2019; Z. J. Wang et al., 2023; Q. Zhang et al., 2023).

Another respondent has compared the transaction cost of BT with the traditional transactions which has a profound gap among each other.

> *"One of the most important features in blockchain that I like is like the transaction fee in the newer blockchains. Just like on secured network, the transaction fees are very low. It's very efficient, and takes about 0.001 dollar per transaction". (Respondent G)*

While transaction cost for the more famous and developed blockchains like Ethereum and Bitcoin, is too high in opinion to some interviewees. Thus, making it a barrier in the adoption process.

> *"If you look at Ethereum or Bitcoin blockchains, their transactional costs during peak activity are insanely high. So, then you start to think, whether this technology is actually ready for mass usage". (Respondent K)*

Some other barriers are the excessive funding needed in the adoption and implementation of the technology such as hardware, implementation cost and hiring cost etc. the expensive nature of the technology is making it barrier in its own adoption. One option is to train the employees and conduct intensive learning courses for them. This can be a cost-efficient solution according to some respondents.

> *"If they want to cost efficient solution, it would be to train their current employees and like teach them about this new technology and then shift their whole ecosystem towards blockchain. So, hiring blockchain developers, senior solution architects and blockchain experts can do the job well". (Respondent H)*

For innovative organizations, learning culture leads to regular seminars or training sessions on emerging technologies or certifications. But it requires resources which are unavailable to even the bigger firms, who outsource their operations to other IT firms. Because they cannot maintain an in-house IT department and bear the expense (Caldarelli et al., 2021). *"Another issue that companies don't have those kinds of resources to hire the blockchain experts, if they can't train their employees" (Respondent C)*. Another problem is the assessment of the blockchain developers which are to be hired. If the organizations come up resources to build its own team of developers and blockchain experts, the management still manage to lack the

skills or knowledge to hire the capable person because of their own unawareness. This issue was raised by multiple interviewees who shared their first-hand experience of being hired. Such organizations have to completely rely on third-party recruiters who are blockchain experts to assess and evaluate the potential applicants, as it is easy to talk about the technology but to really understand the functions and operations is a completely different thing.

> *"The problem is that 90% of the companies don't even know how to interview these candidates. So, assessment of blockchain developers and filtration of developers that which one of these actually know how to deploy the technology for you is very difficult. So, it's not just about the budget. Even if you cross, even if you manage the budget and you want to hire the team, it's very difficult to identify who you want to hire. (Respondent B)*

Finance is always a sensitive matter for any organization especially when the investment risk is too high.

## 4.3 Environmental Factors:

These are the internal and external factors which covers the institutional factors such as government support, involvement of regulatory bodies, standardization of the technology. competitive landscape and risks associated with the blockchain adoption.

### *4.3.1 Associated Risks:*

The perilous nature of the blockchain technology like issues of money laundering, scams, tax evasion problems and other associated risks were a concern for our interviewees. According to many respondents, there have been multiple cases of money laundering in the market, alarming the government and regulatory bodies. Like a respondent said:

> *"You can't track someone you transfer money to, a huge disadvantage of decentralization. Also, Web 3.0 and cryptocurrency is quite into the dark web that's why the money laundering is being possible through it". (Respondent A)*

These unethical issues of scams and con-artists in this sector has disadvantaged the companies in finding and convincing the investors as well. Due to massive amount of such cases, the paranoia among the investors has become quote common. They have revised their contracts and due diligence before signing with any firm or startup.

> *"Venture capitalists are afraid of investing in web 3.0 projects right now due to anonymity of the cofounders. And there were scams of people flying away with the money and not delivering what was promised to the investors. This resulted in strict rules and assessment by the investors". (Respondent E)*

Other alarming activities such as terror financing are also hindering factors at this level. Ethical issues regarding data veracity, corruption in the system can hardly be managed by blockchain. There is no doubt that the technology is bringing transparency and traceability in the system but it doesn't guarantee the authenticity of the data. Thus, involvement of humans in the technological operations raise issues about its usage which cannot be controlled no matter how developed the technology gets.

*"The sad truth is that humans always do mistakes, so it's not the technology as such, but it's the way the technology is being used that's leading to this risk that you as a business could be subject to some of these mistakes" (Respondent Z)*

Technology advancement comes with ethical issues of privacy, security, misuse of information and high volatility. Respondents highlight this factor as a major barrier in the technology adoption. *"The number one barrier an organization faces at most times, is insufficient trust due to the market volatility." (Respondent H)*

The insufficient trust in the technology has led people to consider its adoption to be a risk. They are still doing extensive research and observing other players who have adopted the technology to see whether they are benefitting from it, what are the potential use cases and applications, what kind of risks and issues are they facing etc.

> *"The awareness is not widespread so people are reluctant to adopt it. Cryptocurrencies and digital assets are even though known in the market but people don't trust it even then". (Respondent I)*

Another common barrier which is linked to the unawareness of the technology is its misconception as a cryptocurrency, being infamous as high volatile and fraudulent is a major hinderance in adoption. *"Most of the times, people like to think of blockchain as cryptocurrency, which is a huge misconception, and since they have heard about cryptocurrency is instable and people have been scammed. So, they assume that blockchain is total scam too". (Respondent W)*

Another interviewee said*: "The thing is that people are misconceiving it as cryptocurrency, whereas it's just a small part of the technology. But people are unable to move forward from it." (Respondent F)*

### *4.3.2 Institutional Factors:*

Institutional factors encompass a multifaceted spectrum of influences, including government support, infrastructure changes, and the competitive landscape within the blockchain ecosystem. These components collectively define the socio-economic and regulatory context within which blockchain technology evolves and, in turn, its impact on various industries.

Government support around the globe is a rather challenging and unpredictable. It is changing policies for blockchain adoption with changing seasons. The unawareness lies at the government level as well, which confuses the concept of blockchain with cryptocurrency. As, they are highly reluctant to lose control over financial transactions, they haven't fully developed an adoption policy for the technology.

> *"The technology is in its early adoption phase, not a lot of people are using it at the moment. And the government is skeptical about it due to poor knowledge. The cost and benefit analysis at the government level is unable to see the perceived benefits of the technology. Even if the understanding is there, there is no comprehensive policy existing at this level which is a barrier for mass level adoption". (Respondent Z)*

However, the regulatory bodies of the developed countries who understands the potential of the technology and realizes the fruitful use cases are supporting the businesses to adopt and implement the technology.

> *"A good level of understanding by the government in the West allows you to test out blockchain and cryptocurrencies in like a sandbox mode where you can test it out with in a pilot capacity to prove use cases and applications". (Respondent K)*

Another respondent when asked about the government supporting role in the adoption of blockchain said: *"In some countries, the government is supporting it while some who are not supporting but they are not becoming a hurdle against it as well". (Respondent M)*

Gulf countries like Dubai and Qatar are converting their traditional operating systems to blockchain and accepting the cryptocurrency for their transactions and trading purposes (Almansour et al., 2023).

*"The global government are highly investing into the tech startups and investing a certain amount of their GDP into them because they know that technological sector is the biggest thing that can take their country up and leave an impact in the market. So, they are providing good infrastructure and technical support. Abu Dhabi is very highly investing into Web 3.0 to expand it through the entire infrastructure of the state. Government is building consultancy boards, hiring the best advisors and consultants as their government board members to guide them on policy development on the Web 3.0". (Respondent A)*

Another institutional factor which plays a crucial role in mass adoption of blockchain is the standardization of the technology. Being older than two decades, the technology is yet to be standardized. The development process is ongoing but slow. Dwelling at the immature stage of life cycle is hindering the mass adoption.

*"People are experimenting with it on a smaller level to see if they can adopt it on a higher level. But as the technology is not mature enough to provide more scalable solutions. We have still five to six years to see some huge names adopting the technology". (Respondent H)*

Lack of standardization can be due to the ignorant regulatory or governing bodies. Insufficient use cases and high volatility is also a decisive factor.

*"People want it to be standardized first, and then reach a certain level of standardization to adopt it. The big organizations are waiting for this technology to get more mature and get more features to provide scalable solutions. Right now, it's at a point where management is not comfortable in adopting this technology as they are waiting for some technological advancements". (Respondent H)*

Compatibility with the existing and new infrastructure is a challenging factor in implementation of the blockchain. According to some respondents, this change is not at all complex as conversion from web 2.0 to 3.0 is only a matter of expertise.

*"It fits well with the business processes and the technological infrastructure. It basically adds a layer of security and a layer of robustness on top of the current technological infrastructure of any company". (Respondent L)*

However, this is seen as an expensive transformation due to hardware and other expenses.

Other respondents question the need for this conversion in the first place, as the systems are already running smoothly in major sectors. Many businesses are satisfied with their current infrastructure. Hence this compatibility issue is a strong barrier in the adoption process.

*"Blockchain does not solve every single problem on this planet, so it needs to be compatible with that business and it needs to add value to it. So, compatibility is a problem that needs to be solved first". (Respondent K)*

### *4.3.3 Competitive Landscape:*

The big market players are experimenting with the emerging technologies and paving way for the smaller firms. This competitive landscape is compelling the players to educate, invest and adopt the technology for improved revenue generation. Gaining a competitive advantage from BT, it has become a facilitator in the adoption rate.

*"In certain industries like for example a fashion brand is launching an app collection, the other might follow because they want to stay relevant and they want to stay competitive". (Respondent K)*

But other respondents have associated this competitive air with certain sectors and not a generalized phenomenon. They have limited the competitive advantage of blockchain adoption with technology and finance sector, as these are the ones benefitting the most from it. According to an interviewee:

*"I don't think that there is a race going on apart from some sectors where it's related to finance and blockchain and decentralized finance and decentralized exchanges and financial instruments. On the blockchain, there is a comparative intensity there, but not outside of that industry". (Respondent K)*

Businesses have used the technology for various purposes like supply chain management, financial transactions through digital currencies and other byproducts like NFTs. Thus, having a competitive advantage over their peer businesses.

*"Adopting blockchain would give an upper hand to the companies who have adopted it on the ones who haven't. But this pretty much depends on the industry they belong to or what kind of trading partners it has and whether it was even necessary or not". (Respondent H)*

However, less resourceful organizations are taking their time to 'wait and watch' and learn from the mistakes of the first mover players. According to many respondents, competitive intensity is not a convincing factor to convert firms from their traditional systems to and invest in blockchain.

*"Trading partner readiness is also when one adopts, the other would be more inclined to adopt. But if one rejects, you know others would like to also be more circumspect about whether they should adopt it or not". (Respondent W)*

Another important factor is the intensive hype of BT, which has pressurized the top management to enforce their executives to learn and adopt the technology. This bandwagon effect of excessive hype has twofold nature, acting as a facilitator and a barrier in the adoption process at the same time.

*"If I talk about generative AI, because that's the sort of new upcoming technology people I've seen companies, they are starting to get up to speed with that as well because that is something which is disruptive and which is has the potential to take many companies out of business. If you do not adapt to the new technology, you might get kicked out of the market, so sooner or later they are going to adopt these new technologies". (Respondent P)*

The hype of blockchain has pressurized the management into investing and adopting the technology on ad-hoc basis. For the research and innovation departments, blockchain and other artificial intelligence applications have opened up new opportunities to be explored.

The contingent nature of the competitive landscape is essential for understanding the dynamics of the adoption process of blockchain. As a facilitator, it puts pressure on organizations to adopt the technology when forced by the positive feedback and earnings of competitors, cashing in on the competitive advantage. But when these competitors lose huge investments due to volatility of blockchain and other bad strategic decisions like short-term applications, then it sets an example for the organizations to take a back seat and analyse the technology before adopting it.

# Chapter 5: Discussions

Several recent studies have examined the challenges associated with the adoption of blockchain technology (Caldarelli et al., 2021a; Nath et al., 2022; Toufaily et al., 2021). These studies focus on the impact of technological and institutional factors, such as government and regulatory support, as well as other environmental factors. Additionally, several frameworks have been developed to better understand the process of technology adoption at the organizational level.(Chan et al., 2023; Hakkarainen & Colicev, 2023; Janssen et al., 2020; Toufaily et al., 2021).

Despite numerous studies on blockchain and its potential use cases, the technology still has a long way to go to prove its true worth. While the hype surrounding blockchain is high, the business world remains cautious and is still experimenting to determine its value and use cases, rather than implementing it for existing software (Batchu et al., 2022).

Blockchain technology has found its applications in various fields such as supply chain management, brand authentication, and customer engagement, as suggested by the works of Bai & Sarkis (2020), Kouhizadeh et al. (2021), Nath et al. (2022), and Q. Zhang et al. (2023). However, the appropriate use of this technology is still being questioned. The mass adoption is relatively slower because businesses are not convinced to bring this technological infrastructure change when their systems are working perfectly well. The cost and benefit analysis of blockchain poses a significant challenge. The research supports the findings of E. Toufaily, Felin and Lakhani, who suggest that organizations in all sectors need to create unique value and tangible benefits for all stakeholders. This requires collaboration from all partners involved in the chain (Felin & Lakhani, 2018; Toufaily et al., 2021).

This research study examines the factors that help or hinder the adoption of blockchain technology, while also evaluating how technological, organizational, and environmental factors influence this process. The transparency, traceability, and immutability offered by blockchain are attractive features, but their impact varies for different stakeholders. It is crucial to use this technology for positive purposes in order to achieve widespread adoption, which unfortunately remains an unfulfilled promise. Our study shows that among all the other factors, transparency and complexity of blockchain are the biggest barriers. If organizations are benefitting from technology solutions, they might be compromising on users' personal data and its misuse. To create the ultimate value, companies need to invest heavily in training their

staff to understand and properly deploy the technology. However, this can be a costly and cumbersome process, particularly for organizations that outsource their technology operations to third-party IT firms (Caldarelli et al., 2021). Companies struggle with running in-house IT departments due to lack of resources and the high cost of hiring blockchain developers and analysts, which impedes adoption (C. Zhang & Chen, 2020).

Hence, the technology is self-sabotaging due to its complexity and associated costs (Everett Rogers, 1995). Another organizational factor concurs with Clohessy, that plays a decisive role in aiding the adoption process is the leadership and management support. An autonomous organizational culture leads to better empowerment and trust in employees which drives innovation (Clohessy & Acton, 2019b).

Our study has identified an important factor in the technological advancement of firms - the role of a chief technology officer (CTO). According to many respondents, the CTO is key in introducing the real potential and value of blockchain for businesses. However, there is a problem with the lack of experience or awareness regarding blockchain technology. Typically, a CTO has around 18 to 20 years of experience, but due to the slow development and complexity of blockchain, many lack the necessary expertise in this area.

The study identified another important factor which is the resources required for investing and implementing new technology. Due to the notoriety of BT, investors have made the due diligence process more complicated in order to avoid scammers. The high implementation cost, combined with the added expense of paying high salaries to developers, means that organizations are not willing to invest in it without completing comprehensive research on issues such as scalability and value addition to the system. Such issues of scalability, transaction cost, volatility need to be solved to accelerate the mass adoption.

The concept of permissioned and permissionless blockchain in choosing the right one for the organization was also a determining factor. As the transaction fee of public blockchains like Ethereum and Bitcoin are extremely high with scalability issues makes it inconsiderable (Sanka & Cheung, 2021). Whereas the private blockchains are a better option for internal working but limits the interoperability with trading partners. This dilemma of blockchain with slow development pertains to questionable diffusion of the technology.

As for the environmental factors, associated risks, institutional factors such as government support, infrastructure change, standardization and competitive landscape are the most dominant ones found in the study, which concurs with the finding of Toufaily and Lakhani.

Government support around the globe is the best facilitating factor for accelerating the adoption. As it fears to lose control over the country's economy (Janssen et al., 2020), the governments are developing policies to work collectively with all stakeholders. Apart from coming up with a government-controlled cryptocurrency, they are well aware about the need to partner with businesses. Thus, without a proper policy or governance model, the standardization of the technology is still far-fetched (L. Zhang et al., 2020). People are reluctant to pay in cryptocurrency due to its high volatility, as they are sensitive to lose money (Hakkarainen & Colicev, 2023; Z. J. Zhang, 2023).

The lack of standardization is important barrier in organizational adoption. The firms are circumspect about the investment risks with uncertain returns. Our respondents have collectively agreed about the infancy of blockchain which makes it lose traction for businesses, who rely on successful use cases and value creation. After eliminating the mentioned associated risks, the collaborative effort of stakeholders will fasten the development and deployment of the technology.

TOE framework was previously used in studying the adoption of blockchain and other technologies in various sectors (Kouhizadeh et al., 2021; Saberi et al., 2019b; Wong et al., 2020). The influencing factors are technological characteristics (transparency, immutability, disintermediation and complexity) which are to be understood and exploited in beneficial way for steady adoption. In organizational context of the TOE model, our findings align with the decisive factors like presence of innovation and availability of resources along with the management and leadership support, concurring with Toufaily's framework (Toufaily et al., 2021). The latter framework aligns with our findings about the role of management and autonomous leadership in empowering the employees to drive innovation.

In the environmental context of the framework, some macro factors like government support, change in infrastructure and competitive landscape are discussed. Government and regulatory bodies play a crucial role in making it a safe and workable space for all partners. Trading partner readiness which is discussed in competitive landscape, relates to the network externalities effect in E. Toufaily study, concluding that technology adoption is not a singular decision rather it is the collective support of all trading partners given they are creating and capturing value. Compatibility with the existing business system is a challenge, doubting its efficiency. The decisive factors do not exist in vacuum instead all of them are related to foster the blockchain adoption.

Blockchain being a solution to many issues in luxury and other sectors such as counterfeit, tracking, traceability and gray market is a primary facilitator. The industry is benefitting from generating profits from the NFTs, creating royalty programs and providing customer engagement through the technology (Caldarelli et al., 2021a; Hakkarainen & Colicev, 2023; Klöckner et al., 2023; Park & Lim, 2023). This establishes a trust element in consumers, allowing them to trace their products to its creation process, its authenticity and digital ownership for resale. But the findings show that balance is heavier on the barrier side as to hinder the mass adoption of blockchain, claiming to businesses being satisfied with their current systems to carry out these operations without implementing the technology. The need to educate the consumers for using blockchain whether for payment in cryptocurrency, trusting in monetary security and personal data as well as the businesses to create and explore more value for the technology is consistent.

## 5.1 Proposed Framework

The proposed framework (see Figure 3) can be used by organizations for understanding the relationship of facilitating and hindering factors with the mass adoption of blockchain. The applications and use cases found by the research facilitate the mainstream adoption. Nevertheless, the real enhancing role is played by the influencing factors such as collaboration of stakeholders, whether government, financial entities, policy makers and business leaders in the adoption. This macro-level partnership can achieve the standardization of the technology and establish a governance mechanism which are significant in value creation and business model alignment by blockchain.

A standardized system with policies and regulations is crucial for businesses to succeed. In order to reduce barriers to mass adoption of blockchain technology, regulatory changes must be implemented to control its volatility. This is essential in minimizing the major issue of insufficient trust and expertise in technology. Subsequently, organizations can confidently rely on the system to provide them shelter against the associated risks and scammers, making it easier for the investors to finance the adoption and implementation of technology.

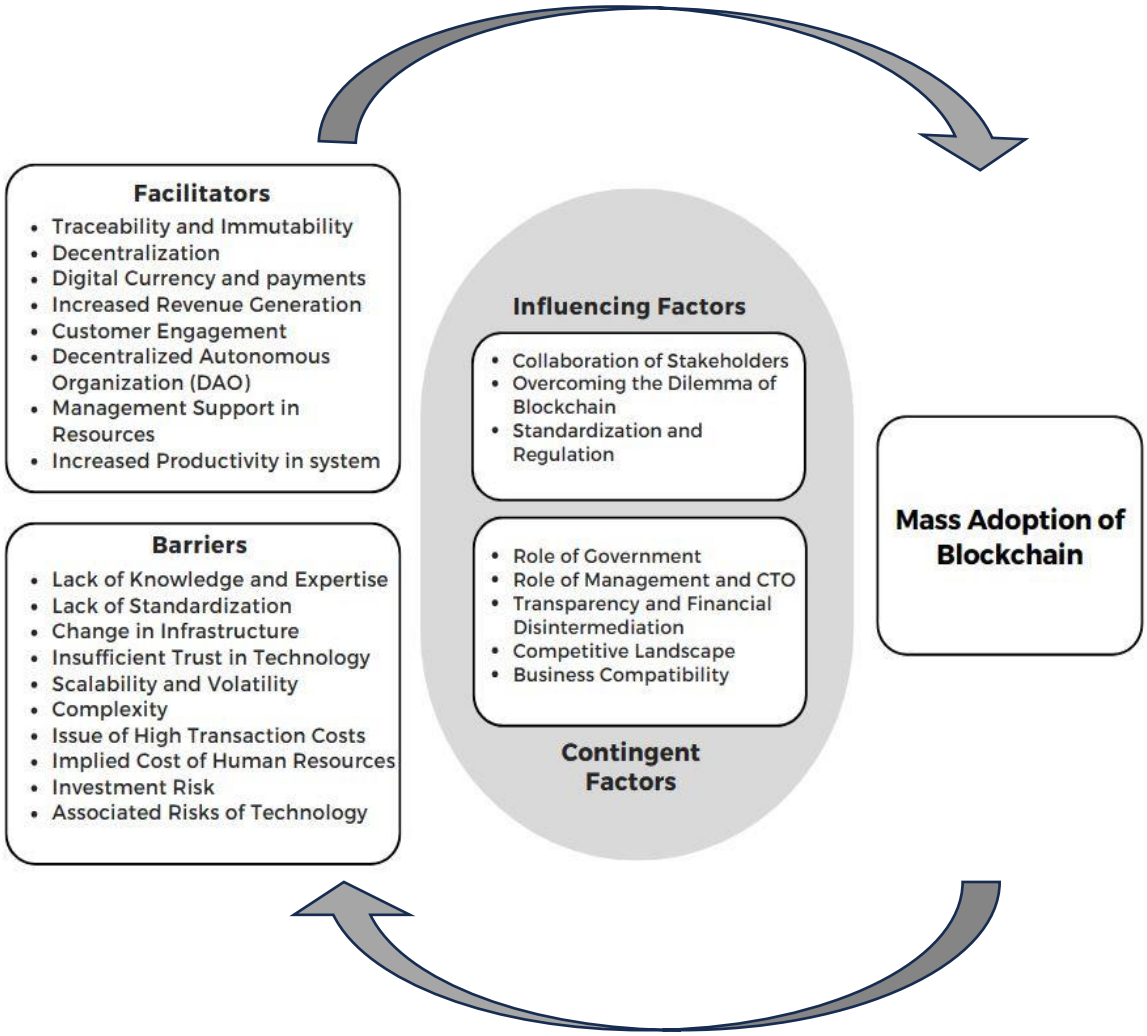


*Figure 2 Proposed Framework for the Mass Adoption of Blockchain Technology*

The research study has a unique finding on contingent factors, which play a dual role in the adoption process. These factors are subject to change and contextual setting, according to which they act as either a facilitator or as a barrier in blockchain adoption. For instance, the role of government is a key factor in determining the pace of technology diffusion. Government of Gulf countries such as Dubai are highly involved in the innovative technological advancement of the system especially through blockchain, as they have successfully introduced their own cryptocurrency and process payments through that currency on blockchain. This supporting role of government and regulatory bodies has instilled a level of trust in organizations to rely on the system and facilitated the mainstream adoption of technology.

Contrary to that, the countries which lags behind in the understanding of technology and fails to regulate it, has caused major hinderance in its spread. The fear of losing control by the governmental entities has even led them to impose bans at times on technology applications in certain regions like the UK and South Asia etc. Thus, the role of government and other contingent factors are significant to decide the direction of adoption rate at mass level.

# Chapter 6: Conclusion, Implications and Future Directions

## 6.1 Conclusion

The research is focused on studying the facilitating and hindering factors influencing the mainstream adoption of blockchain technology at organization level. Blockchain is a breakthrough emerging technology with its potential in various sectors such as supply chain management, sustainability, finance and economy and luxury retail etc. The research has identified various applications and use cases of blockchain technology which are driving its adoption. These factors have caught the attention of the business world as they result in high market demand and revenue generation due to decentralization. The distributed ledger technology comes with imperative barriers which have slowed down the diffusion rate of blockchain. The research builds on the work of Lim (2023) and Toufaily (2021) by studying the significant factors which can streamline the grassroot adoption of technology at organization level.

The most prominent facilitators found in the study are technical factors, potential applications at organizational and sector level. The technical characteristics like transparency, immutability, traceability and decentralized information exchange are valued at every stage. The causal effect of these features are the phenomenal applications such as product authentication, digital ownership and licensing, digital currency and payments, and decentralized system. The consensus mechanism established due to decentralized autonomous organization (DAO) is well-received and promising application of blockchain. However, organizations need to adopt and implement the technology to advantage from these applications which is highly impeded by certain barriers such as slow development and lack of standardization of blockchain. The slower rate of development is owed to the insufficient trust in technology. The organizations are skeptical to adopt blockchain without any regularized governance mechanism which exposes them to enormous threats like financial and information thefts. The research has found some important barriers like lack of awareness and expertise, issues of scalability, trust, security and transaction cost to be troublesome.

Together, these factors contribute to the dilemma of blockchain (security, scalability, transaction cost and trust) which need to be resolved for better understanding of the adoption process. Organizations are made to compromise on either of these factors while selecting a blockchain for their system. The research has highlighted the importance of overcoming this

major problem of lack of standardization and blockchain dilemma which can be achieved through constructive collaboration of stakeholders.

The adjoining efforts of partners ultimately decrease the regulatory uncertainty and increase the trust in technology for both organizations and investors. Consequently, they can consider taking this investment risk and provide resource support to employees to educate and improve their technological skills.

The research study unequivocally highlights the key factors that will drive and accelerate the widespread adoption of blockchain technology. The conceptual framework contributes to the literature by identifying the constructs that affect the relationship between facilitators and barriers in mass adoption and provides clarity of the process. The contributions are further discussed in the next section.

## 6.2 Implications

### *6.2.1 Theoretical Implications*

This research adds to the existing literature on blockchain adoption by providing a comprehensive study of both facilitators and barriers, which are critically related towards mass adoption of blockchain. By synthesizing and building upon existing theoretical frameworks, the study offers a comprehensive analysis of the factors that affect the adoption of blockchain technology, thereby enhancing the level of understanding. The insights presented in the paper can be valuable in enabling a more informed decision-making process for businesses and organizations looking to adopt blockchain.

The research contributes in the refinement of the conceptual framework for innovative technology adoption, particularly blockchain at the organization level. By adding the role of contingent factors to the Technological-Organizational-Environmental Framework (TOE), which are contextual in terms of performance. The integration of influencing and contingent factors allows for a better understanding of the relationship and strength of facilitators and barriers to adoption, to enhance their applicability in the blockchain domain.

The qualitative nature of this study allows for an elaborative exploration of how facilitators and barriers evolve over time and mainly dependent on the sectoral or context setting to play a role. This empirical perspective offers a more dynamic understanding of blockchain mainstream adoption, considering the rapidly changing technological landscape.

### *6.2.2 Practical Implications:*

The research contributes in identification of facilitators which provides actionable insights for businesses to strategically leverage blockchain technology. These positive factors can guide management in business model alignment through blockchain capabilities, thereby enhancing organizational productivity and efficiency. The comprehensive research conducted on the impact of these factors significantly contributes towards resolving regulatory and security concerns, thus leading to a more streamlined adoption process.

The research highlights potential barriers to blockchain adoption such as technological unawareness, insufficient skillset, regulatory and risk challenges. The proposed framework can guide the policymakers and businesses in development of regulatory frameworks that foster innovation while ensuring compliance and security. By proactively addressing these challenges, practitioners can work on technology development and foster collaboration with stakeholders to attain tangible profits.

After conducting this research, it is evident that our findings can have a significant impact on both the theoretical and practical applications of blockchain adoption. The insights we have gained can be used to help make informed decisions at different levels, from strategic business planning to policy formulation, which would ultimately lead to the successful integration of blockchain technology across various sectors.

## 6.3 Limitations and Future Directions:

The research on the facilitators and barriers to blockchain technology adoption from the technology experts provide invaluable insights, but it also has certain limitations. Its limited scope makes it difficult to generalize the findings. To enhance the research's applicability, a broader, multisectoral or multistakeholder perspective could be considered, capturing diverse organizational and regulatory viewpoints.

Additionally, exploring blockchain adoption dynamics across various industries could provide a more comprehensive understanding of the challenges and opportunities, contributing to a better understanding of blockchain adoption. By supplementing qualitative findings with quantitative data, a larger-scale perspective on blockchain adoption dynamics can be achieved, capturing trends and patterns across a more extensive range of organizations. It is important to note that analyzing permissioned and permissionless blockchains separately, which is missing

in this study, could reveal unique challenges and facilitators, contributing to better blockchain adoption understanding.

Furthermore, the study considered TOE framework as a guiding lens which overlooks the size of organization and certain other market factors. Researchers should develop elaborative and comprehensive theoretical frameworks with explanatory power of volatile factors involved in the adoption process. By doing so, the research can provide more detailed insights into the facilitators and barriers of blockchain adoption across various industries and organizations of different sizes and strengths.

To summarise, the research on blockchain adoption in the luxury industry has limitations, it also has significant potential to provide valuable insights that can inform future studies and help organizations adopt this technology more effectively. Addressing these limitations will contribute to more robust and widely applicable findings in the dynamic landscape of blockchain technology adoption.

# Chapter 7: References


Agrawal, T. K., Kumar, V., Pal, R., Wang, L., & Chen, Y. (2021). Blockchain-based framework for supply chain traceability: A case example of textile and clothing industry. *Computers & Industrial Engineering*, *154*, 107130. https://doi.org/10.1016/J.CIE.2021.107130

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Alammary, A., Alhazmi, S., Almasri, M., & Gillani, S. (2019). Blockchain-Based Applications in Education: A Systematic Review. *Applied Sciences 2019, Vol. 9, Page 2400*, *9*(12), 2400. https://doi.org/10.3390/APP9122400

AL-Issa, N., Thanasi-Boçe, M., & Ali, O. (2022). *Boosting Luxury Sustainability Through Blockchain Technology*. 17–46. https://doi.org/10.1007/978-981-19-6569-2_2

Almansour, B. Y., Elkrghli, S., & Almansour, A. Y. (2023). Unravelling the Complexities of Cryptocurrency Investment Decisions: A Behavioral Finance Perspective from Gulf Investors. *International Journal of Professional Business Review: Int. J. Prof.Bus. Rev., ISSN 2525-3654, ISSN-e 2525-3654, Vol. 8, Nº. 7, 2023 (Ejemplar Dedicado a: Continuous Publication; E02568)*, *8*(7), 124. https://doi.org/10.26668/businessreview/2023.v8i7.3265

Andoni, M., Robu, V., Flynn, D., Abram, S., Geach, D., Jenkins, D., McCallum, P., & Peacock, A. (2019). Blockchain technology in the energy sector: A systematic review of challenges and opportunities. *Renewable and Sustainable Energy Reviews*, *100*, 143–174. https://doi.org/10.1016/J.RSER.2018.10.014

Antonucci, F., Figorilli, S., Costa, C., Pallottino, F., Raso, L., & Menesatti, P. (2019). A review on blockchain applications in the agri-food sector. *Journal of the Science of Food and Agriculture*, *99*(14), 6129–6138. https://doi.org/10.1002/JSFA.9912

Araya-Schmidt, T., Olsen, L., Rindahl, L., Larsen, R. B., & Winger, P. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *PeerJ*, *2019*(5). https://doi.org/10.7717/PEERJ.6874/TABLE-2

Awa, H. O., Ukoha, O., & Emecheta, B. C. (2016). Using T-O-E theoretical framework to study the adoption of ERP solution. *Http://Www.Editorialmanager.Com/Cogentbusiness*, *3*(1), 1196571. https://doi.org/10.1080/23311975.2016.1196571

Barrett, M., Davidson, E., Prabhu, J., & Vargo, S. L. (2015). Service Innovation in the Digital Age. *Source: MIS Quarterly*, *39*(1), 135–154. https://doi.org/10.2307/26628344

Batchu, S., Henry, O. S., Patel, K., Hakim, A., Atabek, U., Spitz, F. R., & Hong, Y. K. (2022). Blockchain and non-fungible tokens (NFTs) in surgery: Hype or hope? *Surgery in Practice and Science*, *9*, 100065. https://doi.org/10.1016/J.SIPAS.2022.100065

Bell, E., Bryman, A., & Harley, B. (2022). *Business research methods*. https://books.google.com/books?hl=en&lr=&id=hptjEAAAQBAJ&oi=fnd&pg=PP1&dq=+research+methodology+books+by+bryman&ots=Ddjd49xZXz&sig=cmqwF8bSYxla8kfUDsCRAkdtHKo

Best, R. De. (2023). *DIGITAL & TRENDS Blockchain | Statista*. https://www.statista.com/topics/5122/blockchain/#topicOverview

Biernacki, P., & Waldorf, D. (1981). Snowball Sampling: Problems and Techniques of Chain Referral Sampling. *Sociological Methods & Research*, *10*(2), 141–163. https://doi.org/10.1177/004912418101000205

Brooks, J., Mccluskey, S., Turley, E., King, N., Brooks, J., Mccluskey, S., Turley, E., & King, N. (2015). The Utility of Template Analysis in Qualitative Psychology Research. *Qualitative Research in Psychology*, *12*(2), 202–222. https://doi.org/10.1080/14780887.2014.955224

Bryant, C. G. A., & Jary, D. (2014). Giddens' theory of structuration: A critical appreciation. *Giddens' Theory of Structuration: A Critical Appreciation*, 1–252. https://doi.org/10.4324/9781315822556

Caldarelli, G., Zardini, A., & Rossignoli, C. (2021a). Blockchain adoption in the fashion sustainable supply chain: Pragmatically addressing barriers. *Journal of Organizational Change Management*, *34*(2), 507–524. https://doi.org/10.1108/JOCM-09-2020-0299/FULL/PDF

Caldarelli, G., Zardini, A., & Rossignoli, C. (2021b). Blockchain adoption in the fashion sustainable supply chain: Pragmatically addressing barriers. *Journal of Organizational Change Management*, *34*(2), 507–524. https://doi.org/10.1108/JOCM-09-2020-0299/FULL/PDF

Chan, H. L., Choi, T. M., & Mendez De la Torre, D. (2023). The "SMARTER" framework and real application cases of blockchain. *Technological Forecasting and Social Change*, *196*, 122798. https://doi.org/10.1016/J.TECHFORE.2023.122798

Choi, T. M. (2019). Blockchain-technology-supported platforms for diamond authentication and certification in luxury supply chains. *Transportation Research Part E: Logistics and Transportation Review*, *128*, 17–29. https://doi.org/10.1016/J.TRE.2019.05.011

Choi, T. M., & Luo, S. (2019). Data quality challenges for sustainable fashion supply chain operations in emerging markets: Roles of blockchain, government sponsors and environment taxes. *Transportation Research Part E: Logistics and Transportation Review*, *131*, 139–152. https://doi.org/10.1016/J.TRE.2019.09.019

Clohessy, T., & Acton, T. (2019a). Investigating the influence of organizational factors on blockchain adoption: An innovation theory perspective. *Industrial Management and Data Systems*, *119*(7), 1457–1491. https://doi.org/10.1108/IMDS-08-2018-0365/FULL/PDF

Clohessy, T., & Acton, T. (2019b). Investigating the influence of organizational factors on blockchain adoption An innovation theory perspective The influence of organizational factors. *Industrial Management & Data Systems*, *119*(7), 1457–1491. https://doi.org/10.1108/IMDS-08-2018-0365

Clohessy, T., Acton, T., & Rogers, N. (2019). Blockchain Adoption: Technological, Organisational and Environmental Considerations. *Business Transformation through Blockchain*, 47–76. https://doi.org/10.1007/978-3-319-98911-2_2

Cole, R., Stevenson, M., & Aitken, J. (n.d.). *Blockchain technology: implications for operations and supply chain management*. https://doi.org/10.1108/SCM-09-2018-0309

Cong, L. W., & He, Z. (2019). Blockchain Disruption and Smart Contracts. *The Review of Financial Studies*, *32*(5), 1754–1797. https://doi.org/10.1093/RFS/HHZ007

Coyne, J. G., & McMickle, P. L. (2017). Can Blockchains Serve an Accounting Purpose? *Journal of Emerging Technologies in Accounting*, *14*(2), 101–111. https://doi.org/10.2308/JETA-51910

Creswell, J. (2014). *A concise introduction to mixed methods research*. https://books.google.com/books?hl=en&lr=&id=51UXBAAAQBAJ&oi=fnd&pg=PR1&dq=+research+methodology+books+by+creswell&ots=6bCnP4RlJB&sig=e6w80XnFdQ_B85pVsaxyXN0OK5g

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly: Management Information Systems*, *13*(3), 319–339. https://doi.org/10.2307/249008

de Boissieu, E., Kondrateva, G., Baudier, P., & Ammi, C. (2021). The use of blockchain in the luxury industry: supply chains and the traceability of goods. *Journal of Enterprise Information Management*, *34*(5), 1318–1338. https://doi.org/10.1108/JEIM-11-2020-0471/FULL/PDF

DeSanctis, G., & Poole, M. S. (1994). Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. *Undefined*, *5*(2), 121–147. https://doi.org/10.1287/ORSC.5.2.121

Drescher, D. (2017). Blockchain Basics: A Non-Technical Introduction in 25 Steps. *Undefined*, 1–255. https://doi.org/10.1007/978-1-4842-2604-9

Everett Rogers. (1995). Diffusion of innovations. *Retrieved January*. https://www.academia.edu/1988400/Diffusion_of_innovations_by_Everett_Rogers_1995_

Farahani, B., Firouzi, F., & Luecking, M. (2021). The convergence of IoT and distributed ledger technologies (DLT): Opportunities, challenges, and solutions. *Journal of Network and Computer Applications*, *177*. https://doi.org/10.1016/J.JNCA.2020.102936

Feldman, S. (2019). *Chart: What's Blocking Blockchain? | Statista*. https://www.statista.com/chart/17948/worlwide-barriers-to-blockchain-adoption/

Felin, T., & Lakhani, K. (2018). What Problems Will You Solve with Blockchain. *MIT Sloan Management Review*.

Finlay, L., & Gough, B. (2008). Reflexivity: A Practical Guide for Researchers in Health and Social Sciences. *Reflexivity: A Practical Guide for Researchers in Health and Social Sciences*, 1–255. https://doi.org/10.1002/9780470776094

Flick, U. (2017). *The SAGE Handbook of Qualitative Data Collection*. 1–736.

Gatteschi, V., Lamberti, F., Demartini, C., Pranteda, C., & Santamaría, V. (2018). Blockchain and Smart Contracts for Insurance: Is the Technology Mature Enough? *Future Internet 2018, Vol. 10, Page 20*, *10*(2), 20. https://doi.org/10.3390/FI10020020

Ghode, D., Yadav, V., Jain, R., & Soni, G. (2020). *Adoption of blockchain in supply chain: an analysis of influencing factors*. https://doi.org/10.1108/JEIM-07-2019-0186

Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication & Technology*, *29*(2), 75–91. https://doi.org/10.1007/BF02766777/METRICS

Guest, G., Namey, E., & Mitchell, M. (2013). *Collecting qualitative data: A field manual for applied research*. https://books.google.com/books?hl=en&lr=&id=--3rmWYKtloC&oi=fnd&pg=PP1&dq=Guest+namey+and+mitchell&ots=F_Rcf7jsS5&sig=NpQsi8d8Kdfpz-j_P4J_oP361Sg

Guo, S., Choi, T. M., & Shen, B. (2020). Green product development under competition: A study of the fashion apparel industry. *European Journal of Operational Research*, *280*(2), 523–538. https://doi.org/10.1016/J.EJOR.2019.07.050

Gupta, Prof. S., Wang, Dr. Y., Patel, Dr. P., & Czinkota, Prof. M. (2022). *Future of AI in Marketing - Forthcoming Special Issues - International Journal of Information Management - Journal - Elsevier*. International Journal of Information Management. https://journals.elsevier.com/international-journal-of-information-management/forthcoming-special-issues/future-of-ai-in-marketing

Hair, J. F., Page, M., & Brunsveld, N. (2020). Essentials of Business Research Methods Fourth Edition. *Routledge Taylor & Francis Group*, 3–495.

Hakkarainen, T., & Colicev, A. (2023). Blockchain-enabled advances (BEAs): Implications for consumers and brands. *Journal of Business Research*, *160*, 113763. https://doi.org/10.1016/J.JBUSRES.2023.113763

Hawlitschek, F., Notheisen, B., & Teubner, T. (2018). The limits of trust-free systems: A literature review on blockchain technology and trust in the sharing economy. *Electronic Commerce Research and Applications*, *29*, 50–63. https://doi.org/10.1016/J.ELERAP.2018.03.005

He, Z., & Turner, P. (2021). A Systematic Review on Technologies and Industry 4.0 in the Forest Supply Chain: A Framework Identifying Challenges and Opportunities. *Logistics 2021, Vol. 5, Page 88*, *5*(4), 88. https://doi.org/10.3390/LOGISTICS5040088

Hölbl, M., Kompara, M., Kamišalić, A., & Zlatolas, L. N. (2018). A Systematic Review of the Use of Blockchain in Healthcare. *Symmetry 2018, Vol. 10, Page 470*, *10*(10), 470. https://doi.org/10.3390/SYM10100470

Janssen, M., Weerakkody, V., Ismagilova, E., Sivarajah, U., & Irani, Z. (2020). A framework for analysing blockchain technology adoption: Integrating institutional, market and technical

factors. *International Journal of Information Management*, *50*, 302–309. https://doi.org/10.1016/J.IJINFOMGT.2019.08.012

Joy, A., Zhu, Y., Peña, C., & Brouard, M. (2022). Digital future of luxury brands: Metaverse, digital fashion, and non-fungible tokens. *Strategic Change*, *31*(3), 337–343. https://doi.org/10.1002/JSC.2502

King, N. (2017). Doing Template Analysis. *Qualitative Organizational Research: Core Methods and Current Challenges*, 426–450. https://doi.org/10.4135/9781526435620.N24

Klöckner, M., Schmidt, C. G., Fink, A., Flückiger, L., & Wagner, S. M. (2023). Exploring the physical–digital interface in blockchain applications: Insights from the luxury watch industry. *Transportation Research Part E: Logistics and Transportation Review*, *179*, 103300. https://doi.org/10.1016/J.TRE.2023.103300

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. https://doi.org/10.1016/J.IJPE.2020.107831

Kouhizadeh, M., & Sarkis, J. (2018). *Blockchain Practices, Potentials, and Perspectives in Greening Supply Chains*. https://doi.org/10.3390/su10103652

Kurpjuweit, S., Schmidt, C. G., Klöckner, M., & Wagner, S. M. (2019). Blockchain in Additive Manufacturing and its Impact on Supply Chains. *Undefined*, *42*(1), 46–70. https://doi.org/10.1111/JBL.12231

Lacity, M. C. (2018). 17:3) | MIS Quarterly Executive. *Growing Business Interest in Blockchain Technology*, *12*. https://angel.co/blockchains

Lihniash, S., Egdair, I., & Ahmed, S. (2019). The Proposed Conceptual Framework to Understand the Effect of the Technology Organization Environment (TOE) Model on Internet Financial Reporting (IFR) in Libyan Financial Institutions. *Open Journal of Business and Management*, *07*(02), 339–347. https://doi.org/10.4236/OJBM.2019.72023

Lim, E. T. K. (2023). Blockchain innovations: Technological applications and management challenges. *Information & Management*. https://doi.org/10.1016/j.im.2023.103756

Lippert, S. K., & Govindarajulu, C. (2006). Technological, Organizational, and Environmental Antecedents to Web Services Adoption. *Undefined*.

Lu, Y. (2019). The blockchain: State-of-the-art and research challenges. *Journal of Industrial Information Integration*, *15*, 80–90. https://doi.org/10.1016/J.JII.2019.04.002

Luthra, S., & Mangla, S. K. (2018). Evaluating challenges to Industry 4.0 initiatives for supply chain sustainability in emerging economies. *Process Safety and Environmental Protection*, *117*, 168–179. https://doi.org/10.1016/J.PSEP.2018.04.018

Madill, A., Jordan, A., & Shirley, C. (2000). Objectivity and reliability in qualitative analysis: realist, contextualist and radical constructionist epistemologies. *British Journal of Psychology (London, England : 1953)*, *91 ( Pt 1)*(1), 1–20. https://doi.org/10.1348/000712600161646

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 2021, Vol. 13, Page 9404*, *13*(16), 9404. https://doi.org/10.3390/SU13169404

Martins, R., Oliveira, T., & Thomas, M. A. (2016). An empirical analysis to assess the determinants of SaaS diffusion in firms. *Computers in Human Behavior*, *62*, 19–33. https://doi.org/10.1016/J.CHB.2016.03.049

Meraviglia, L. (2018). Technology and counterfeiting in the fashion industry: Friends or foes? *Business Horizons*, *61*(3), 467–475. https://doi.org/10.1016/J.BUSHOR.2018.01.013

Molinillo, S., & Japutra, A. (2017). Organizational adoption of digital information and technology: a theoretical review. *Bottom Line*, *30*(1), 33–46. https://doi.org/10.1108/BL-01-2017-0002/FULL/PDF

Mougayar, W., & Vitalik Buterin. (2016). *The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology | Wiley*. 208. https://www.wiley.com/en-us/The+Business+Blockchain%3A+Promise%2C+Practice%2C+and+Application+of+the+Next+Internet+Technology-p-9781119300311

Myers, M. D. (Michael D. (2020). *Qualitative research in business & management*. 358.

Nakamoto, S. (2008). *Bitcoin: A Peer-to-Peer Electronic Cash System*. www.bitcoin.org

Nash, H. (2022). *Digital Transformations | Statista*. https://www.statista.com/statistics/661164/worldwide-cio-survey-operational-priorities/

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/FULL/PDF

Noble, H., & Smith, J. (2015). *Issues of validity and reliability in qualitative research*. https://doi.org/10.1136/eb-2015-102054

ÖZ CEVİZ, N. (2021). DIGITAL TRANSFORMATION IN THE TEXTILE INDUSTRY. *SOCIAL MENTALITY AND RESEARCHER THINKERS JOURNAL*, *7*(54), 3700–3709. https://doi.org/10.31576/SMRYJ.1292

Ozdemir, A. I., Ar, I. M., & Erol, I. (2020). Assessment of blockchain applications in travel and tourism industry. *Quality and Quantity*, *54*(5–6), 1549–1563. https://doi.org/10.1007/S11135-019-00901-W/TABLES/3

Park, H., & Lim, R. E. (2023). Fashion and the metaverse: Clarifying the domain and establishing a research agenda. *Journal of Retailing and Consumer Services*, *74*, 103413. https://doi.org/10.1016/J.JRETCONSER.2023.103413

Patton, M. Q. (2005). Qualitative Research. *Encyclopedia of Statistics in Behavioral Science*. https://doi.org/10.1002/0470013192.BSA514

Plewa, C., Troshani, I., Francis, A., & Rampersad, G. (2012). Technology adoption and performance impact in innovation domains. *Undefined*, *112*(5), 748–765. https://doi.org/10.1108/02635571211232316

Pournader, M., Shi, Y., Seuring, S., & Koh, S. C. L. (2020). Blockchain applications in supply chains, transport and logistics: a systematic review of the literature. *Undefined*, *58*(7), 2063–2081. https://doi.org/10.1080/00207543.2019.1650976

Puschmann, T., & Alt, R. (n.d.). Sharing Economy. *Business & Information Systems Engineering*, *58*. https://doi.org/10.1007/s12599-015-0420-2

Puthal, D., Malik, N., Mohanty, S. P., Kougianos, E., & Yang, C. (2018). The Blockchain as a Decentralized Security Framework [Future Directions]. *IEEE Consumer Electronics Magazine*, *7*(2), 18–21. https://doi.org/10.1109/MCE.2017.2776459

Rashid, Y., Rashid, A., Warraich, M. A., Sabir, S. S., & Waseem, A. (2019). Case Study Method: A Step-by-Step Guide for Business Researchers. *International Journal of Qualitative Methods*, *18*. https://doi.org/10.1177/1609406919862424

Remme, A. M. R., Stange, S. M., Fagerstrøm, A., & Lasrado, L. A. (2022). Blockchain-enabled Sustainability Labeling in the Fashion Industry. *Procedia Computer Science*, *196*, 280–287. https://doi.org/10.1016/J.PROCS.2021.12.015

Ribeiro, F. A., & Brito, M. A. (2022). Blockchain Technology Applications: Enhancing Fashion Supply Chain Sustainability. *Iberian Conference on Information Systems and Technologies, CISTI*, *2022-June*. https://doi.org/10.23919/CISTI54924.2022.9820395

Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019a). Blockchain technology and its relationships to sustainable supply chain management. *Undefined*, *57*(7), 2117–2135. https://doi.org/10.1080/00207543.2018.1533261

Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019b). Blockchain technology and its relationships to sustainable supply chain management. *Undefined*, *57*(7), 2117–2135. https://doi.org/10.1080/00207543.2018.1533261

Sadhya, V., & Sadhya, H. (2018). *Barriers to Adoption of Blockchain Technology Barriers to Adoption of Blockchain Technology Completed Research*.

Sanka, A. I., & Cheung, R. C. C. (2021). A systematic review of blockchain scalability: Issues, solutions, analysis and future research. *Journal of Network and Computer Applications*, *195*, 103232. https://doi.org/10.1016/J.JNCA.2021.103232

Saunders, M., Lewis, P., Thornhill, A., Lewis, S. •, & Thornhill, •. (2009). *Research methods for business students fi fth edition*. www.pearsoned.co.uk

Skafi, M., Yunis, M. M., & Zekri, A. (2020). Factors influencing SMEs' adoption of cloud computing services in Lebanon: An empirical analysis using TOE and contextual theory. *IEEE Access*, *8*, 79169–79181. https://doi.org/10.1109/ACCESS.2020.2987331

Sun, S., Hall, D. J., & Cegielski, C. G. (2020). Organizational intention to adopt big data in the B2B context: An integrated view. *Industrial Marketing Management*, *86*, 109–121. https://doi.org/10.1016/J.INDMARMAN.2019.09.003

Symon, G., & Cassell, C. (2012). Qualitative Organizational Research: Core Methods and Current Challenges. *Qualitative Organizational Research: Core Methods and Current Challenges*. https://doi.org/10.4135/9781526435620

Tapscott, D., & Tapscott, A. (2018). Blockchain revolution : how the technology behind bitcoin and other cryptocurrencies is changing the world. *How the Technology behind Bitcoin and Other Cryptocurrencies Is Changing the World*, 560. https://eds.s.ebscohost.com/eds/detail/detail?vid=1&sid=87e318f8-de2c-4f01-b633-df9acef92f34%40redis&bdata=Jmxhbmc9ZXMmc2l0ZT1lZHMtbGl2ZSZzY29wZT1zaXRl#AN=sib.000099803&db=cat00798a

Taylor, P. J., Dargahi, T., Dehghantanha, A., Parizi, R. M., & Choo, K. K. R. (2020). A systematic literature review of blockchain cyber security. *Digital Communications and Networks*, *6*(2), 147–156. https://doi.org/10.1016/J.DCAN.2019.01.005

Thanasi-Boçe, M., AL-Issa, N., & Ali, O. (2022). *Combating Luxury Counterfeiting Through Blockchain Technology*. 1–16. https://doi.org/10.1007/978-981-19-6569-2_1

Tijan, E., Aksentijević, S., Ivanić, K., & Jardas, M. (2019). Blockchain Technology Implementation in Logistics. *Sustainability 2019, Vol. 11, Page 1185*, *11*(4), 1185. https://doi.org/10.3390/SU11041185

Tönnissen, S., & Teuteberg, F. (2020). Analysing the impact of blockchain-technology for operations and supply chain management: An explanatory model drawn from multiple case studies. *International Journal of Information Management*, *52*, 101953. https://doi.org/10.1016/J.IJINFOMGT.2019.05.009

Tornatzky, L. G., Fleischer, Mitchell., & Chakrabarti, A. K. (1990). processes of technological innovation. *The Processes of Technological Innovation*, 298. https://doi.org/10.3/JQUERY-UI.JS

Toufaily, E., Zalan, T., & Dhaou, S. Ben. (2021). A framework of blockchain technology adoption: An investigation of challenges and expected value. *Information & Management*, *58*(3), 103444. https://doi.org/10.1016/J.IM.2021.103444

Venkatesh, V. G., Kang, K., Wang, B., Zhong, R. Y., & Zhang, A. (2020). System architecture for blockchain based transparency of supply chain social sustainability. *Robotics and Computer-Integrated Manufacturing*, *63*. https://doi.org/10.1016/J.RCIM.2019.101896

Wang, C., & Zhao, J. (2023). Network approaches in blockchain-based systems: Applications, challenges, and future directions. *Computer Communications*, *212*, 141–150. https://doi.org/10.1016/J.COMCOM.2023.09.018

Wang, Y., Han, H., & Beynon-Davies, P. (n.d.). *Understanding blockchain technology for future supply chains: a systematic literature review and research agenda*. https://doi.org/10.1108/SCM-03-2018-0148

Wang, Z. J., Chen, Z. S., Xiao, L., Su, Q., Govindan, K., & Skibniewski, M. J. (2023). Blockchain adoption in sustainable supply chains for Industry 5.0: A multistakeholder perspective. *Journal of Innovation and Knowledge*, *8*(4). https://doi.org/10.1016/j.jik.2023.100425

Weiner, B. J. (2009). A theory of organizational readiness for change. *Undefined*, *4*(1). https://doi.org/10.1186/1748-5908-4-67

*What Is Disruptive Innovation?* (n.d.). Retrieved 30 September 2022, from https://hbr.org/2015/12/what-is-disruptive-innovation

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. https://doi.org/10.1016/J.IJINFOMGT.2019.08.005

Yadav, V. S., Singh, A. R., Raut, R. D., & Govindarajan, U. H. (2020). Blockchain technology adoption barriers in the Indian agricultural supply chain: an integrated approach. *Resources, Conservation and Recycling*, *161*. https://doi.org/10.1016/J.RESCONREC.2020.104877

Yermack, D. (2017). Corporate Governance and Blockchains. *Review of Finance*, *21*(1), 7–31. https://doi.org/10.1093/ROF/RFW074

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. https://doi.org/10.1371/JOURNAL.PONE.0163477

Younas, A., Porr, C., Maddigan, J., Moore, J. E., Navarro, P., & Whitehead, D. (2023). The Pathway Building Technique in Implementation Research Using Mixed Methods Design. *Canadian Journal of Nursing Research*. https://doi.org/10.1177/08445621231213432/ASSET/IMAGES/LARGE/10.1177_08445621231213432-FIG2.JPEG

Zhang, C., & Chen, Y. (2020). A Review of Research Relevant to the Emerging Industry Trends: Industry 4.0, IoT, Blockchain, and Business Analytics. *Https://Doi.Org/10.1142/S2424862219500192*, *5*(1), 165–180. https://doi.org/10.1142/S2424862219500192

Zhang, L., Xie, Y., Zheng, Y., Xue, W., Zheng, X., & Xu, X. (2020). The challenges and countermeasures of blockchain in finance and economics. *Systems Research and Behavioral Science*, *37*(4), 691–698. https://doi.org/10.1002/SRES.2710

Zhang, Q., Jiang, X., & Zheng, Y. (2023). Blockchain adoption and gray markets in a global supply chain. *Omega*, *115*, 102785. https://doi.org/10.1016/J.OMEGA.2022.102785

Zhang, Z. J. (2023). Cryptopricing: Whence comes the value for cryptocurrencies and NFTs? *International Journal of Research in Marketing*, *40*(1), 22–29. https://doi.org/10.1016/J.IJRESMAR.2022.08.002

# Appendices

## Appendix 1: Interview Guide

**Part 1**

1. What is your name?

2. What is the name of the company you work for?

3. In which country is your company located?

4. What is your position at work?

5. How many years of work experience do you have?

6. How many years of knowledge/experience of blockchain technology do you have?

7. What is/was the status of organization's involvement with blockchain technology?

**Part 2**

**Organizational Factors:**

- What kind of organizational barriers/facilitators are there in the adoption of blockchain?
- What kind of role did the top management play? (IT-related decisions, providing necessary resources, BT as strategically important)
- How is organizational innovativeness (new ideas, taking risks) important to adopt an emerging technology?
- How is organizational learning capability (to motivate employees to store and acquire new skills/technology etc) important and being managed in your firm for disruptive technologies such as blockchain?
- What kind of challenges do organizations face in financing blockchain adoption? (hiring and training employees, hardware cost of blockchain and other costs)

**Technological Factors:**

- What kind of technological barriers/facilitators exist in the adoption process?
- What are the perceived benefits of blockchain technology? how does it facilitate the businesses? How is blockchain compatible with the current business and does it face any challenge?

- How is the complexity of technology related to its adoption? Do organizations face this challenge and how do they overcome it?
- What technological characteristics of blockchain are faced as barriers to adoption? Do they play a dual role in a certain context? If yes, how?
- Do you have any other technological barrier in mind?

**Environmental Factors:**

- What environmental factors exist in the adoption process?
- What is the role of government in blockchain adoption?
- How does trading partner readiness act in fostering the adoption process? Is it seen as a facilitator or a barrier to blockchain adoption?
- How is competitive intensity shaping the adoption of blockchain? How are firms handling the pressure of competitors adopting blockchain?
- Why is the adoption of blockchain relatively slow? What are the environmental challenges being faced by the organizations?
- What are the perceived risks of blockchain technology? How is it affecting the adoption process?
- Do you have any other factor in mind?

## Appendix 2: Participant Information Sheet

| | |
|---|---|
| Name of Researcher<br><br>Name of Organization | Dania Bilal<br><br>NUST Business School, NUST Islamabad |
| Name of Supervisor<br><br>Name of Organization | Dr. Owais Anwar Golra<br><br>NUST Business School, NUST Islamabad |

**Introduction**

As a student of MS Innovation & Entrepreneurship, I am conducting this research in innovative and emerging technologies to explore the adoption process of blockchain technologies in organizations. The aim of this research is to explore the factors which are acting as facilitators or as barriers in the mainstream adoption of blockchain. In order to obtain an in-depth analysis, data is being collected from the blockchain analysts, experts and developers through interviews.

Before you decide to take part, we would like to let you know about the study and what it involves. This leaflet provides the information you may require before giving your consent.

**Purpose of the Study**

The objective of the research is to explore the barriers and facilitators in blockchain technology adoption at organization level. Expert opinions from the blockchain analyst, experts and developers along with senior management are needed to achieve this purpose. The interview guide is prepared to obtain data on the major factors fostering blockchain adoption.

**Why have I been invited to take part?**

You are being invited to take part in this research because we feel that your experience can contribute much to our understanding and knowledge of use to understand the blockchain sector and its potential applications as well as the challenges being faced in its adoption process.

**Voluntary Participation**

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. The choice that you make will have no bearing on your job or on any work-related

evaluations or reports. You may change your mind later and stop participating even if you agreed earlier.

**Reimbursement**

You will not be provided any incentive or payment to take part in the research.

**How much time and effort is required?**

The interview/discussion is anticipated to take 30-40 minutes, maximum an hour.

**Benefit**

There will be no direct benefit to you, but your participation is likely to help us find out more about the blockchain adoption process and factors involved for its facilitation.

**Risks**

No risks are involved except using your time for the interview.

**Confidentiality**

Your name will not be shared with the other participants in the study and your data will be protected by removing names and identifiers from the transcripts and ensuring that only the researcher has access to your data. The interview recordings will not be heard by anyone other than the researcher and will be kept secure. Any information about you will have a number on it instead of your name.

Only the researcher will know what your number is, and your data will be stored in a locked filing cabinet or in password protected computer. In our reports, I may quote you, writing down what you said in your own words, but I will not use any information which could identify you (like your name, where you work etc.). The recordings and data will be destroyed after 3 years of this research.

**Who to Contact?**

If you have any questions, please ask now or later. You may contact any of the following:

**Researcher**

Dania Bilal

Email: dania.msie21nbs@student.nust.ed

## Appendix 3: Participant Consent Form

*Please read and complete this form carefully. Please initial the following statements if you are happy with them and leave blank any that you are not happy with. If you do not understand anything and would like more information, please ask.*

| | Initials |
|---|---|
| The research has been explained to me in a way I can easily understand (written or verbal) | |
| I have had the opportunity to ask questions about the study and understand what is involved. | |
| I understand that my interview will last no more than one hour and will be recorded by using digital equipment. | |
| I understand that it will not be possible to identify me when using direct quotations from me in future publications. | |
| I understand that I may withdraw from this study at any time without having to give an explanation. This will not affect me in any way. | |
| I am willing for my anonymized data to be archived and used for this research project and I understand that all data will be destroyed at the end of the project. | |

**I freely give my consent to participate in this research study and have been given a copy of this form for my own information.**

| | |
|---|---|
| Participant Name: | Date: |
| Signature: | |
| Name of the Person taking Consent: | Date: |
| Signature | |