LUND UNIVERSITY
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Department of Informatics

The Diffusion of Blockchain in SMEs:

The Driving and Determining Factors for Blockchain Technology Adoption in SMEs

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Authors: Mohammed Roqa
Tom Wiström

Supervisor: Paul Pierce

Grading Teachers: Asif Akram
Miranda Kajtazi

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AUTHORS: Mohammed Roqa and Tom Wiström

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ABSTRACT (MAX. 200 WORDS):
Blockchain technology has in recent years gained significant momentum in a wide variety of industries. However, in the context of SMEs the IS body of research is lacking, both in terms of why SMEs should consider this new technology and the factors that affect a potential adoption. To explore this research gap, the authors derived a conceptual framework from the existing literature along with elements from TOE-framework, DOI theory and TAM. Further, the authors explored these constructs along with experts from the field, through the use of four interviews. The driving factors for blockchain technology adoption in SMEs was shown to be related to the technological factor of relative advantage, while many organizational and environmental factors along with the technological factors of complexity and compatibility was shown to play an import role in affecting the adoption of blockchain for SMEs.

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1 Introduction

1.1 Background

Blockchain technology has recently gained considerable momentum in different types of businesses (Tumasjan & Beutel, 2019) and supports a variety of decentralized applications enabled by its immutable, decentralized, and trustless properties (Ilbiz & Durst, 2018; Kifokeris & Koch, 2019; Molinillo & Japutra, 2017; Sun et al., 2020; Wong et al., 2020). In a recent survey of a sample of 1488 senior executives and practitioners in 14 countries, 88% claimed that blockchain technology is broadly scalable and will eventually achieve adoption, and 83% believed that it will disrupt their industry and their organizations will lose competitive advantage if they do not adopt blockchain technology (Deloitte Insights, 2020). Moreover, despite the fact of some arguments that blockchain is an immature and could be a risky technology (Frizzo-Barker et al., 2020), there have been an increasing positive attitude toward blockchain in different market segments in EU (Deloitte Insights, 2020). As an emerging technology set to improve public and social entities in terms of security and privacy (Akram et al., 2020), it gives rise to several scholarly description of Blockchain. However, blockchain can be defined as a shared digital information stored in a digital ledger to be distributed among nodes on a peer-to-peer (decentralized) platform which allows anonymous interaction between multiple users on the same network without centralized middleware or third-party intermediaries (International Finance Corporation, 2019; Pervez & Haq, 2019; Lacity, Steelman & Cronan, 2019). A distributed ledger technology (DLT) network can be either open (permission-less) or private (permissioned) in which assets are cryptographically secured using a public-private key combination. Several start-ups such as, OpenBazaar, La'Zooz, and LaborX aim at creating an alternative to "sharing economy" platforms, switching from "centralized" business models into a decentralized business models, to avoid relatively high transaction fees (Tumasjan & Beutel, 2019) (Figure 1.1 adapted from International Finance Corporation, 2019). A traditional intermediary is employed and creates costs for the services of providing credibility and reducing the uncertainty of trading with unknown partners (Sun et al., 2020; International Finance Corporation, 2019).

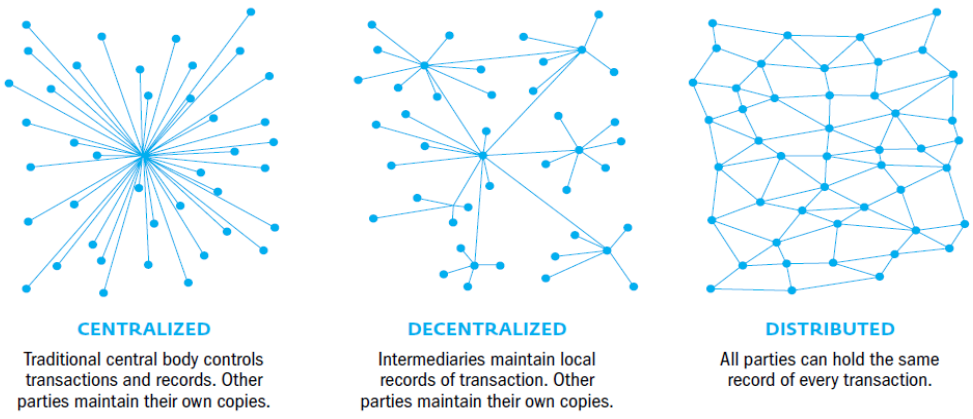

Figure 1.1: Evolution of Ledgers

Considering the European Union (EU) definition for SMEs as a company with less than 250 employees and account for either a yearly turnover not more than €50 million or a yearly

capital with total of but not more than €43 million (European Commission, 2016). SMEs are the backbone of economy, accounting for more than 85 percent of new job creation in Europe and are affected by onerous regulations (European Commission, 2016). Thus, blockchain technology might bring a great benefit to SMEs and public services but can be risky (Niforos, 2019; Nuryyev et al., 2020). This risk can be surfaced if SMEs are not considering the factors that influence a new technology adoption such as, characteristics of the company, management and competitiveness strategies of the company, the impact of both the internal and external stakeholders on decision-making process for adoption and features of new technologies adopted (Lefebvre, Harvey & Lefebvre, 1991).

Bendell (2017) claims to the sustainable financing issue in SMEs that stagnating economies and growing inequality are consequences of the mainstream monetary systems and the implications for inadequate financing of SMEs and microenterprises. In addition, he states that for SMEs sustainability, it is needed to adopt "complementary currency" and more integrated system for direct business benefit. While Sun et al. (2020) states that trust and transparency are the top two benefits of blockchain technology to help improve corporate governance. Such as, smart contracts improve the execution time of transactions significantly and increase transaction volume rapidly. In addition, one of the most significant issues for SMEs is access to capital that affect their growth and development. Therefore, blockchain technology and its consensus algorithm create trust among untrusted entities by solid protection mechanism and thereby reducing transaction costs and promoting efficiency and transparency of transactions (International Finance Corporation, 2019), (Figure 1.2 adapted from International Finance Corporation, 2019).

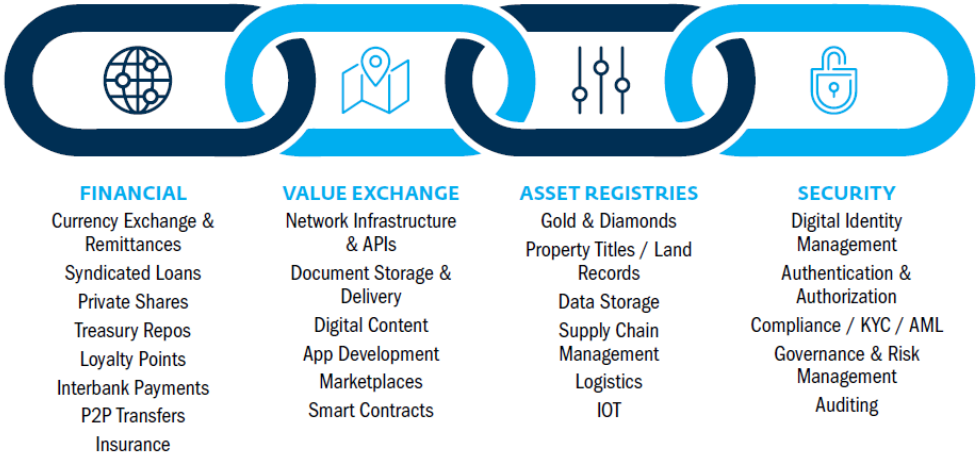

Figure 1.2: Blockchain Value Chain

The combinational features of blockchain may prove its perfection to be adopted and make a huge impact on growth. Moreover, blockchain will further transform the structure of an organization from hierarchies toward electronic markets in a way that transparency and traceability of the blockchain digital ledger will significantly reduce the cost of validating trading partners (Sun et al., 2020). It also can promote the development and implementation of low-carbon energy solutions that enable SMEs to achieve their future visions (International Finance Corporation, 2019). Moreover, SME's who can provide goods and services on a wide scale while using few resources and having a relatively low negative environmental impact are likely to have competitive advantage (Ministry of Enterprise and Innovation, 2016). A

typical use case of blockchain is supply chain network where blockchain creates transparency among all stakeholders to achieve a more elevated level of safety and the capacity to follow a shipment continuously to diminish mistakes and transaction times to the negligible (Kshetri, 2018; Kummer et al., 2020; Ramachandran & Rehermann, 2017; Wong et al, 2020).

In February 2018, the EU Blockchain Observatory Forum was started to assemble data from EU members on blockchain use cases and engage experts and practitioners prior to defining solid approaches (Niforos, 2019). According to the ministry of enterprise and innovation in Sweden, that the rapid pace of technological growth is a huge challenge for small businesses (Ministry of Enterprise and Innovation, 2016). Despite this fact, blockchain technology aims to re-engineer all the business processes and digitize many business operations to create a network of new ecosystems and stakeholders (Bennett et al., 2021; Kifokeris & Koch, 2019). This aims to solve several potential issues such as paperwork, defrauding, delayed deliveries and low productivity, while foster trust, transparency, traceability, quality and facilitate the collaboration (Bennett et al., 2021; Kifokeris & Koch, 2019). Some initiatives in Swedish market are land registry (Bennett et al., 2021) and construction management (Kifokeris & Koch, 2019). Since a sociotechnical approach has embraced in the development of digitalization (Kifokeris & Koch, 2019), the partnership of SMEs with the research community, as well as the interchange between industries and firms, must be increased (Ministry of Enterprise and Innovation, 2016). This paper seeks to identify the driving and determining factors that facilitate the adoption of blockchain by SMEs. It will theoretically draw on an interpretivist approach, and methodologically will build on a literature review and dialogues with consultants and managers active in building blockchain ecosystems within Sweden.

1.2 Research Problem

Blockchain technology has become increasingly recognized within several sectors such as, government, finance, health, education and manufacturing (Casino, Dasaklis & Patsakis, 2019). Although, it has been recently investigated (Frizzo-Barker et al., 2020), as an emerging technology, there is a limited empirical evidence on how to use the technology (Ying, Jia & Du, 2018). In addition, the literature on blockchain technology in the IS discipline is still in its infancy (Hughes et al., 2019). While there is a modest body of literature on blockchain applications and adoption, research on the adoption of blockchain by SMEs is scarce (Casino, Dasaklis & Patsakis, 2019; Ilbiz & Durst; 2019). Furthermore, the IEEE blockchain initiative has been certified to serve as a centre for standards and pre-standards activities, and publications related to blockchain technology (IEEE, n.d.). There are few papers that have been published that contribute to SMEs.

The adoption of emerging technologies, such as blockchain, is one of the success factors that enable organizations to increase their efficiency, capital and quality (Ilbiz & Durst, 2019). However, blockchain technology is considered applicable to large enterprises (Ilbiz & Durst, 2019), while many issues have yet to be addressed (Casino, Dasaklis & Patsakis, 2019). Due to the nature of an emerging technology that may produce new types of business and social interaction (Frizzo-Barker et al., 2020), risk taking can seem particularly difficult due to factors such as, market uncertainty. SMEs are seeking to use a disruptive technology and re-innovate their business models. Since SMEs are vital for a healthy economy (Ilbiz & Durst,

2019) with limited resources, it is crucial to address issues that threaten their competitive advantage, sustainability and their entry to market.

1.3 Research Motivation

The recent rise of blockchain technology has prompted many initiatives to be conceived and can have an impact on businesses that disrupt information systems and social relations (Frizzo-Barker et al., 2020). As a disruptive innovation, blockchain is characterized by being a decentralized architecture, trustless and permissionless systems, smart contracts, as well as data, privacy, and information management (Frizzo-Barker et al., 2020). However, the lack of focus on blockchain adoption of the research body in IS journals would not help SMEs to be able to adopt and implement blockchain applications. Thus, unsophisticated studies on how to adopt it or which framework to use will cause SMEs to have difficulty in understanding blockchain technology (Wong et al, 2020). Further, SMEs often lack the resources to invest in emerged technologies, while still having the same need to be effective and efficient in their allocation and management of their resources as larger enterprises (Sihn et. al, 2016). To understand such a phenomenon, it is also necessary to understand the associated conditions and processes within social settings (Frizzo-Barker et al., 2020). Thus, a qualitative study has the potential to yield useful and distinctive insights into the adoption of blockchain technology by SMEs.

1.4 Research Aim

The purposes of this study are to investigate why SMEs should consider blockchain technology (the driving factors) and the important aspects that SMEs need to consider that might affect the adoption of blockchain technology (the determining factors). In addition, it will use TOE, TAM and DOI theories for factor categorization and to provide indications for these theoretical perspectives to understand technological adoption in the context of SMEs. Accordingly, a conceptual framework is constructed based on findings from the literature review. In recent years, the emergence of blockchain technology as an innovation concept is considered a solution to several conventional business-related challenges (IIbiz & Durst, 2019). The need to examine and understand the driving and determining factors for blockchain technology adoption by SMEs is significantly important which are the leading research questions for this study.

1.5 Research Question

As we observe a gap in the adoption of blockchain by SMEs and as the value of blockchain for SMEs remains uncertain, this thesis seeks to add to the IS area of research by investigating whether the usage of blockchain technology is a worthwhile undertaking for SMEs. We intend to investigate the driving and determining factors of blockchain technology that may be used to inspire and achieve a successful adoption. As a result, our thesis will attempt to answer the following research questions:

What are the driving factors for blockchain technology adoption in SMEs?

What are the determining factors that affect the adoption of blockchain technology in SMEs?

1.6 Delimitation

This study seeks to investigate the driving and determining factors for blockchain technology adoption in SMEs. However, it would be impossible to cover every single factor that concerns these research questions, this study will instead focus on a selection of factors, identified through the literature review. Further, the determining factors will only be identified and discussed but no suggestion for how SMEs should use these factors during the adoption process will be given.

2 Literature review

2.1 Blockchain Technology

Blockchain technology started in 2008 when Nakamoto proposed a solution of a purely peer-to-peer system that allows online payments to be sent directly from one party to another without going through a trusted third-party (Nakamoto, 2008). Blockchain is a protocol of open, transparent, and secure distributed ledger technology of valid blocks to ensure security, anonymity, and data integrity without any third-party to control the transactions (Yli-Huumo et al., 2016). It is also defined to be a team technology (Kifokeris & Koch, 2019), an emerging and potentially disruptive technology that has the characteristics of a general-purpose technology (GPT) (Frizzo-Barker et al., 2020; Kane, 2017; Pilkington, 2015) which might create new foundations for social and economic systems (Iansiti & Lakhani, 2017). Blockchain technology is based on a distributed transaction database where different computers, called nodes, interact as a system to store sequences of fragments with encrypted interconnected blocks (Nakamoto, 2008). To achieve a high degree of security, blockchains are based on cryptographic hash functions (Nakamoto, 2008). These files can be given through the blockchain technology a unique code created by a cryptographic hash function (Nakamoto, 2008). Each block can be identified by a cryptographic hash for its contents and is linked to the identity of the previous block (Nakamoto, 2008). These blocks are described by the concept of "distributed ledger" (Ziechmann, 2021). Therefore, the operational design of the information to be gathered and communicated among users has been changed dramatically (Bauerle, 2018; Janssen, et al., 2020).

However, digital cryptocurrencies such as, bitcoin, are based on the notion of computing graphs and construct new digital financial networks with different purposes (Swan, 2019). Economic payment and credit networks will make the shift to blockchain networks in the digital sphere (Swan, 2019). In the next subsection, some examples are presented in more details. Additionally, blockchain technology is going beyond the facilitation of electronics payment, while enterprises are exploring blockchain technologies to capture significant business value (Lacity, 2018; Swan, 2019). Lacity, Steelman and Cronan (2019) present the three eras of Blockchain development. Bitcoin is the first blockchain application, which produce Blockchain 1.0 era from 2009 to 2015 (Figure 2.1 adapted from Lacity, Steelman & Cronan, 2019). The Blockchain 2.0 era began in 2015 with the launch of Ethereum, a decentralized platform that allows developers to use smart contracts to build applications on top of it (Lacity, Steelman & Cronan, 2019). The Blockchain 3.0 era has recently released, and it aims to improve scalability, interoperability, privacy, and sustainability applications (Lacity, Steelman & Cronan, 2019).

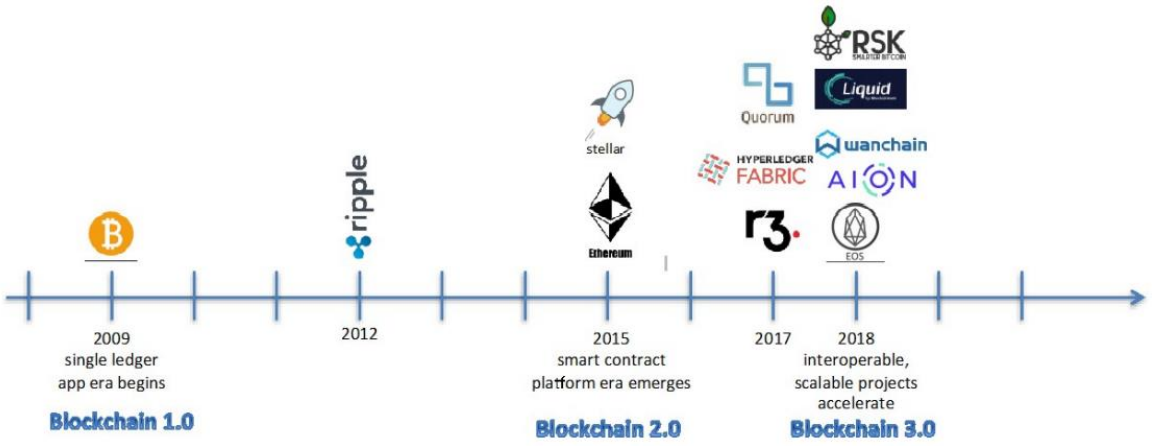

Figure 2.1: Timeline of Blockchain Eras

Blockchain 2.0 was started by Ethereum in 2015 (Lacity, Steelman & Cronan, 2019) as a foundation of thousands of digital solutions through a peer-to-peer network (Ziechmann, 2021). One of the most popular applications that runs on the Ethereum blockchain are smart contracts (Ziechmann, 2021; Lacity, Steelman & Cronan, 2019). Smart contracts are a collection of functions and data that resides at a specific address on the Ethereum blockchain platform (Ziechmann, 2021) to maintain autonomous, self-sufficient and decentralised agreement (Ross, 2016). Bennett et al. (2021) presents a comparative analysis of three proof-of-concept studies in Sweden, Australia and Canada where smart contracts are applied for specific land dealings within specific jurisdictions. In addition, blockchain aims to tackle the challenges related to supply chains such as, risk assessment and flow optimization. Chang et al. (2019) study the smart contract-based tracking process in supply chain where an electronic contract triggers the process to move on to the next step. Buyers can thus be confident that products are in a predetermined condition, and sellers can ensure that a payment of the right amount is made at the right time (Choi et al., 2020). However, to overcome the interoperability issue, the third generation of blockchain 3.0 was released in 2018. Blockchain 3.0 projects aim to interconnect multiple blockchain platforms to improve the interoperability, scalability, security, and performance of blockchains using mostly “Proof of Stake” and other new consensus protocols (Lacity, Steelman & Cronan, 2019). An example of this is integration between multiple private blockchains or blockchains with legacy systems such as, Hyperledger Fabric and R3 (Lacity, Steelman & Cronan, 2019). In particular, blockchain technology has dramatically increased due to its operational characteristics and benefits (Clohessy, Acton & Rogers, 2019), while promoting anonymity (Zyskind, Nathan & Pentland. 2015), immutability (Pilkington, 2015), sustainability, trust (Mendling et al. 2017), transparency (Kosba et al. 2016), and efficiency (Kiayias & Panagiotakos, 2019). The worldwide blockchain industry is expected to reach USD 69.04 billion by2027, growing at a CAGR of 56.1 percent throughout that time (Fortune Business Insights, 2020).

2.1.1 Blockchain Status and SMEs

Digitalization has created a monumental base for the transformation of many organizations size and effect. Likewise, the emerged blockchain technology is part of the holistic picture

that organizations are likely to adopt. Blockchain technology has grown in a rapid pace across several industrial sectors (Hughes et al., 2019) would indicates an intention of adoption towards shifting into new innovations (European commission, 2019) as shown in Figure 2.2 (Adapted from European commission).

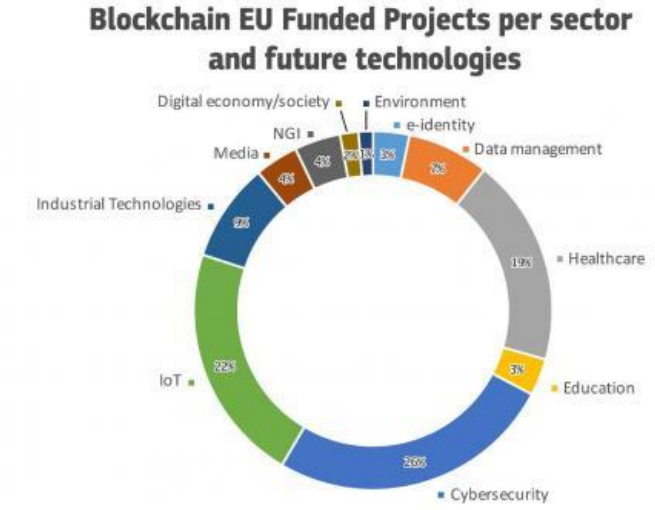

Figure 2.2: Blockchain European funded projects

In addition, EU is going forward by adopting a strong regulatory and policy framework that supports blockchain innovations in start-up ecosystems such as, finance innovative model (European commission, 2019). Since this paper focuses on the driving factors of blockchain adoption in Sweden, it conducts a review of the status quo for the blockchain in Sweden and the adoption by Swedish SMEs. Therefore, it is worth mentioning some SMEs key characteristics to accurately perceive reality. However, researchers have drawn some characteristic for SMEs, first, they have limited resources (Thong, 2001). Second, they are most likely to have informal management style (Slade, 2005). Third, SMEs have more flexibility to adapt to changes in the environment due to its size, but any change might lead to a negative impact (Lazarević-Moravčević, Stevanović, & Belopavlović, 2014). Fourth, planning and development in SMEs are not given sufficient time if compared to large enterprises (Lazarević-Moravčević, Stevanović, & Belopavlović, 2014). The fifth one is that SMEs are highly centralized (Lazarević-Moravčević, Stevanović, & Belopavlović, 2014) and managed by the owner or individual decision maker (Barnett et al., 2005). SMEs have a functional organizational structure that are characterized by clearly defined hierarchical levels, formalization, standardization, clearly defined jobs, tasks and roles of individuals (Lazarević-Moravčević, Stevanović, & Belopavlović, 2014).

Furthermore, according to MIT, Sweden's central bank has initiated a development of a digitalized version of the Swedish currency Krona using distributed ledger technology inspired by blockchains that operate cryptocurrencies (Orcutt, 2020). Their objective is to make a digital payment system that support private sector as well as individuals (Orcutt, 2020). According to OECD Ilibrary (2020) around 99% of limited liability companies with employees in Sweden were SMEs which account for about 53% of total employment and 45% of GDP. Therefore, the use of information and communication technologies (ICT) by SMEs has a great impact on the improvement of business competitiveness and drives SMEs into a sustainable business (Bayo-Moriones & Lera-Lo´pez, 2007). In turn, new business models and service offerings

will be emerged through digitalization in the way it has the potential to be powerful through integration with Industry 4.0 technologies which will introduce blockchain 4.0 (Subic et al., 2018). This paradigm shift of the automated machine-to-machine architecture and Hyperledger fabric applications shapes the digital future of the machine and sharing economy (Subic et al., 2018; Miehle et al., 2019).

2.1.2 Characteristics of Blockchain

From the literature, many defining characteristics of blockchain technology have been identified due to the unique design of the ledger structure, the network, consensus protocol and cryptographic mechanisms it uses Paik et al. (2019), these characteristics are summarized below:

- *Decentralization* - Kouhizadeh and Sarkis (2018) describe the decentralized database architecture as the core feature of Blockchain technology that allows its users to reap the benefits of increased reliability of data and recorded transactions with the use of consensus algorithms. The decentralized nature of blockchain means that it can avoid the negative aspects of centralized networks such as single point of failure and scalability, instead blockchain with the use of a distributed ledger uses the processing capabilities of all the users in the blockchain network which leads to reduced latency and the prevention of single point of failure (Atlam & Wills, 2019). Viriyasitavat and Hoonsopon (2019) also argues that the decentralized architecture leads to a decrease in server costs, such as development costs and operational costs since blockchain allows its user to make transactions among peers within the network without the use of any central authority and being able to reduce insufficient performance through the central server. Tian (2016) also argues that a centralized database is more likely to be exposed to threats such as hacking, corruption or crashing, while blockchain with its decentralization offers greater data validity and verifiability through its easy access of transaction records with distributed ledgers (Crosby et al., 2016).
- *Immutability* - An essential feature of blockchain technology is that the information that is stored on the blockchain is argued to be immutable due to the technology's distributed consensus mechanism (Montecchi, Plangger, & Etter, 2019). Immutability means that the information stored in the blockchain cannot be altered and is unable to be corrupted without an overwhelming consensus from the players within the network (Kouhizadeh & Sarkis, 2018; Paik et al., 2019). This leads to benefits such as more reliable transactions and protection from fraud (Montecchi, Plangger, & Etter, 2019). However, the use of these distributed consensus mechanisms means that if one user controls more than half of the nodes in the network then they are free to change or remove information from a public blockchain (Lin & Liao, 2017), on the other hand Bashir (2017) states that this would require an unaffordable amount of computing resources.
- *Transparency* - Blockchain technology offers a high level of transparency for all its users due to inherent nature of the technology, blockchain allows all users of the system to be able to read and verify every transaction and its associated value (Seebacher & Schüritz, 2017; Paik et al., 2019). This allows for benefits in the form of traceability, for example, transactions within the blockchain enables the enhancement of traceability in supply chains, it is also possible to trace the origin of any data which enables the tracking of asset lifetimes (Sultan, Ruhi & Lakhani, 2018). Another benefit of the traceability of the blockchain is that it can be used to establish consumer trust, this

because the technology can be used to validate product origin, authenticity and integrity (Montecchi, Plangger, & Etter, 2019).

- *Data integrity* - Seebacher and Schüritz (2017) argues that the use of blockchain technology ensures the integrity of data, since it stores the data in the database itself and because the direct interaction of it is secured through public-key cryptography and since all users can verify transactions based on predefined rules. The use of cryptography allows for the authentication through transactions among anonymized users, which is argued to a crucial requirement for public blockchains to ensure that the system is trustworthy (Kouhizadeh & Sarkis, 2018).

In addition to the above characteristics, blockchain technology are characterized by its consistency and availability with distributed equal rights among all participants in the network (Paik et al., 2019).

2.1.3 Blockchain Technology Adoption

There have been several research studies on the driving and determining factors for a multitude of emerging technology adoption by enterprises. The emergence of these technologies enables new possibilities across many industries. However, Ilbiz & Durst (2019) assess the appropriation of blockchain technology and possibilities for decision makers in SMEs to thoroughly look over if the innovative features of blockchain are feasible in their current business processes. They conceptualize nine driving factors that include reduction of costs, internalization, digital representation of assets, immutability, network size, transparent and synchronized ledger, scalability, fair trade and financing. Kulkarni & Patil (2020) study the adoption of blockchain on an organizational level according to the technology, organization and environment (TOE) theoretical framework (Tornatzky & Fleischer, 1990). The TOE framework was developed by Tornatzky and Fleischer (1990) to identify three aspects within an organizational context that influences the adoption of a technological innovation which are in the technological, organizational and environmental context. The TOE framework has been used in many technology-based studies to examine factors that drive blockchain adoption within enterprises (Kulkarni & Patil, 2020; Kouhizadeh, Saberi & Sarkis, 2021; Clohessy, Acton & Rogers, 2019; Choi et al., 2020; Wong et al., 2020; Janssen et al., 2020; Ilbiz & Durst, 2019). In addition, a fundamental theory for technology acceptance, is named technology acceptance model (TAM), was introduced by Davis (1989). TAM is measured by two theoretical constructs, perceived usefulness and perceived ease of use as determinants of user behaviour (Davis, 1989). Since 1989, TAM has been one of the most cited and most modified theories in IS research (Bagozzi, 2007). Moreover, Rogers (1983) defines the diffusion of innovation theory (DOI) which consists of five distinct attributes of innovation to predict future rate of adoption. The five attributes of innovations are, relative advantage, compatibility, complexity, trialability, and observability (Figure 2.3 adapted from University of Maryland, n.d.). More generally, TAM constructs are consistent with the characteristics of an innovation and its adoption. However, the relative advantage, observability, trialability and compatibility of an innovation, as perceived by members of a social system, are positively related to its rate of adoption while complexity is negatively related (Rogers, 1983). Other variables affect its rate of adoption as the type of innovation decision and the nature of the social system (Rogers, 1983).

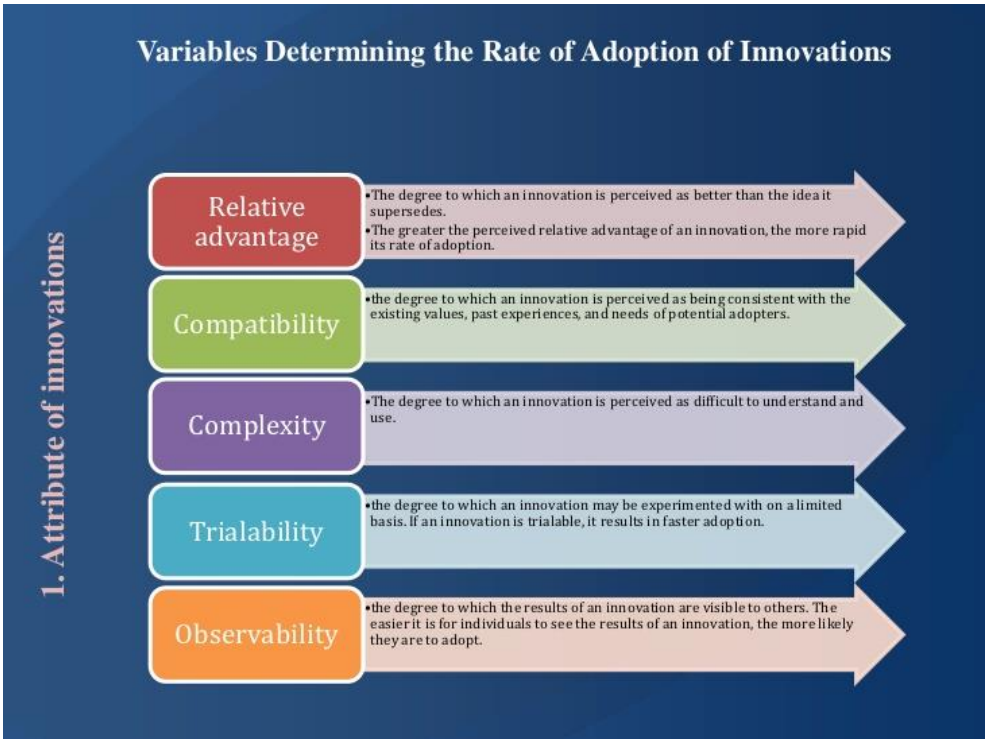

Figure 2.3: Diffusion of Innovation Model

However, there are a significant number of studies that have been undertaken to explain the adoption of different types of technology innovations using TOE, TAM and DOI. Those studies measure the attitudes towards adoption of blockchain in enterprises (Table 2.1). The willingness to adopt refers to the motivation to embrace a replacement technology more than the one currently in use (Anderson, 1993). To better perceive the fundamental elements that influence the adoption of blockchain technology, the following are the theorized classification to several key characteristics. A concept matrix (Oates, 2006; Webster & Watson, 2002) of the study's literature papers can be found in Table 2.1 below:

Table 2.1: Concept Matrix of Blockchain Adoption

Author/Date	Context	Concept	Analysis & Result
(Molinillo & Japutra, 2017; Wong et al., 2020; Kifokeris & Koch, 2019; Ilbiz & Durst, 2018)	Organizational adoption of ICT and blockchain by SMEs.	Driving factors	- Reduce operating costs - Improve quality - Large market share - Stakeholder's satisfaction - Efficiency - Collaboration - Innovation - Competitive advantage - Higher immutability - Increasing transparency. - Security and protection. - Internationalization - Fair trade - Network size

(Nuryyev et al., 2020; Liu & Ye, 2021; Semenova, 2020; Barnes, Bruce & Xiao, 2019; Swan, 2019; Daluwathumullagamage & Sims, 2020)	The influencing factors of Blockchain & emerging technology adoption behavior and sustainability of the business.	Determining factors	- Strategic orientation - Managers personal characteristics - Customer Trust - Customer knowledge quality - Infrastructure and resources - Expertise & knowledge - Top management support - External pressure (competitors, Trading partner support, Technology vendor support, Governmental support, Customer support) - Critical mass - Perceived usefulness - Technological compatibility - Organizational readiness - Firm size
(Frizzo-Barker et al., 2020; Kummer et al., 2020; Kouhizadeh, Saberi & Sarkis, 2021; Janssen et al., 2020; Park, 2020; Clohessy, Acton & Rogers, 2019; Swan, 2017)	Blockchain technology adoption drivers & benefits.	Driving factors	- Smart contracts - Decentralized organizations - Efficiency - Competitive advantage - Cost reduction - Reliable networks - Trust - Anonymity - Security - Data integrity - Social Influence (Welfare) - Performance Expectancy - Decentralization - Transparency - Immutability
(Choi et al., 2020; Kouhizadeh, Saberi & Sarkis, 2021; Janssen et al., 2020)	The adoption of blockchain technologies barriers and challenges.	Determining factors	- Complexity (expertise) - Scalability (information and data capacity) - Compatibility with legacy systems - Regulations and legal frameworks - Immaturity of blockchain - Cultural resistance - Information sharing risk - Lack of management commitment - Lack of knowledge and expertise - Organizational resources - Inter-organizational relationship - External pressures - Critical mass adoption - Organization centralization

2.1.4 Limitations of Blockchain Technology

Even though the use of blockchain technology has grown in recent years, it also has its shortcomings and flaws. First, the consensus mechanism is computationally inefficient and uses a lot of energy (Swan, 2019). Second, interpretability is a key factor for success for many blockchain solutions, which means that enterprises first need to solve business issues such as identity, data standards, and shared governance for the integration with legacy systems or for two or more blockchain ecosystems to interoperate (Lacity, Steelman & Cronan, 2019). There will be problems with the adoption if these issues are not resolved (Lacity, Steelman & Cronan, 2019). Third, scaled deployment of smart contract principle using blockchain in mature industries, such as those with a lot of government regulation or regulatory authority, is still limited (Bennett et al., 2021). In addition, Frizzo-Barker et al. (2020) mention the top challenges and risks associated with blockchain by following a systematic review of the literature. Those are scalability, reliability, volatility, security, wasted resources, negative environmental impact and lack of universal standards. At the enterprise level, several challenges including,

that 34% of the issues are related to governance and regulation, 29% represents a barrier for effectively incorporating blockchain into existing market and management processes and 5% is a lack of common standards (Frizzo-Barker et al., 2020). The blockchain ecosystem requires a greater workforce of technical talent to roll out blockchain implementations across different industries and businesses for successful diffusion to occur (Frizzo-Barker et al., 2020).

2.2 Blockchain Adoption Conceptual Framework

The articles in table 2.1 provides rigorous theoretical support for this paper. These findings not only shed light on specific blockchain adoption factors, but also provide general theoretical viewpoints. Having the TOE, TAM and DOI theories for categorization of factors will provide indications for these theoretical perspectives to understand the technological adoption of blockchain in SMEs. Accordingly, a conceptual framework is developed based on the findings of the three models. By integrating the key technical features of blockchain in terms of innovation constructs under the technological context of TOE, we can gain a better understanding of the factors that influence user acceptance for this emerged technology, which in turn will affect the perceived usefulness and ease of use. The following table 2.2 describes all the potential variables that could affect the adoption of blockchain technology at organizational level:

Table 2.2: Blockchain Adoption Factors

TECHNOLOGICAL	
Relative advantage	Decentralization; Internationalization; Trust; Transparent; Immutability; Reduce operating costs; Security and protection; Competitive advantage; reliable networks; large market share; Data integrity.
Complexity	Cultural resistance; Organization centralization; Technical complexity;
Compatibility	Technological interoperability; Scalability (information and data capacity)
ORGANIZATIONAL	
Management support	Support of top management; Managers personal characteristics;
Innovative business model	Strategic orientation
Financial and technical resources	Infrastructure & Resource's availability; Infrastructure & Resource's Accessibility.
Organizational readiness (size, expertise, leadership capabilities)	Firm size; Expertise & knowledge;

ENVIRONMENTAL	
Competitive pressure	Performance Expectancy;
Stakeholder support	Collaboration; Inter-organizational relationship; Network size;
Consumer readiness	Customer Trust; Customer knowledge quality;
Market uncertainty	Maturity of blockchain; Critical mass adoption;
Government pressure	Regulations and legal frameworks; Fair trade;

The speed at which a new technology is adopted is determined by how well it is known and trusted. Blockchain adopters might be challenged in that a new digital paradigm cannot be a mass appealing for the whole population. Therefore, incorporating complexity and compatibility into our framework can advance our understanding of how the technological characteristics of blockchain can be associated to the SMEs intentions for accepting blockchain technology. In addition, blockchain's transparency and immutability will provide SMEs relative advantage in market competition among rivals. Figure 2.4 shows the conceptual framework:

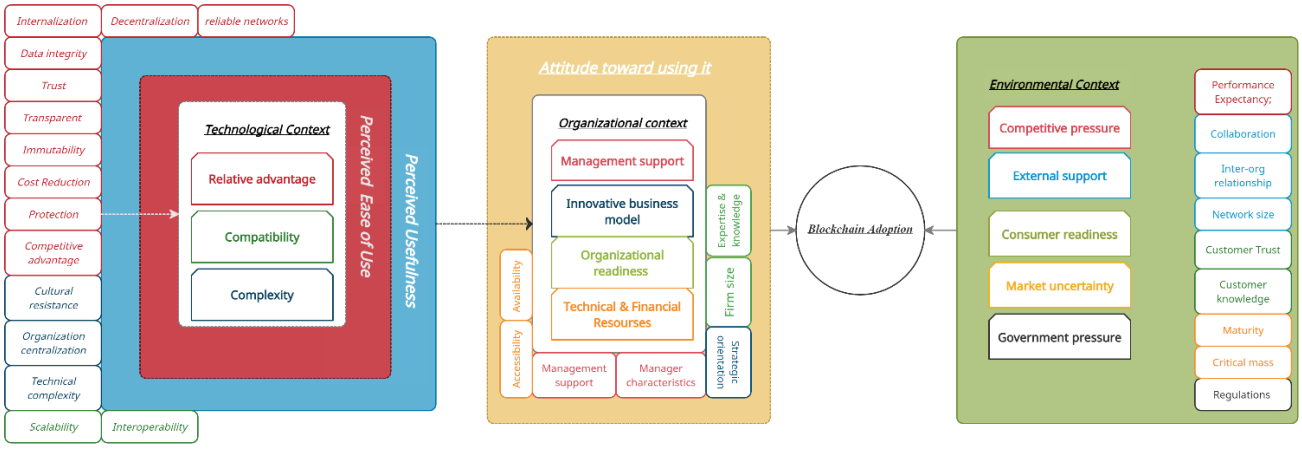

Figure 2.4: Blockchain Adoption Conceptual Framework

We categorise the findings from our literature review into 3 specific research contexts, technology, organization and environment. Moreover, these findings provide insights into specific blockchain adoption process by conceptually integrating TAM, DOI and TOE constructs. Thus, in our evaluation of the driving and determining factors of blockchain adoption for SMEs, we find some significant aspects of the adoption process need to be covered. For example, innovation and acceptance of such an emerged technology may affect the relationships amongst these factors and determine the convergence point of adoption.

In figure 2.4, we identify all potential factors within technological context according to coloured attributes of the DOI theory characterized by relative advantage, compatibility and complexity. TAM theory is expanding the understanding of TOE framework. SMEs could perceive “ease of use” based on these underlying factors, which in turn result in influencing perceived usefulness. Therefore, perceived usefulness will affect organizational factors. For example, management support, accessibility, availability and re-innovate the business model create a positive attitude towards using blockchain technology. In addition, organizational readiness by building knowledge and expertise is an important factor of the organizational context. Further, as SMEs work within a market network and have relationships with others, there are external factors affect their ability to adopt a new technology. Those might be considered under the environmental context. Such as the case of competitive pressure that created by inter-organizational relationships and collaborations. Also, incorporating customer, and other stakeholder aspects can help the adoption of blockchain technology. However, the three context categories explored in this study for blockchain adoption in SMEs are preliminary in nature and thus should provide SMEs managers and decision makers with the information needed to construct plans towards blockchain technology adoption.

Overall, the conceptual framework can be summarized as follow:

- The factors of technological context have the greatest prominence as they have direct impact on the construct "Perceived Ease of Use". Further, it mediates between the factors and the construct "Perceived Usefulness".
- Perceived usefulness is a crucial antecedent for effectively creating an organizational attitude toward blockchain technology.
- The attitude toward using blockchain is grounded on management support, innovative business model, organizational readiness and technical and financial resources.
- Besides that, external factors have an impact on encouraging advancements in blockchain technology investments.
- These external factors are studied under the environmental context and independently affect the blockchain adoption.
- The final stage is “blockchain adoption” in which managers and owners have the intention to use.

3 Methodology

This chapter describes the implementation of the study, as well as selected working methods for the research purpose, research approach, research strategy, data collection and analysis. Then, it presents the ethical considerations, as well as the scientific quality to ensure our research quality.

3.1 Research Strategy

According to the research question, the thesis aims to conduct a qualitative analysis to peruse two main objectives. First, to identify the driving and determining factors that influence the adoption of blockchain technology by SMEs. Second, to propose a conceptual framework as a reference of blockchain technology adoption by SMEs according to those factors from an organizational perspective. For our research approach we used a qualitative approach with an inductive reasoning to generalize the findings based on specific observations (Recker, 2013). In recent years, the emergence of blockchain technology as an innovative concept is considered a solution to several conventional business-related challenges. However, since SMEs have its own organizational settings and represent 99% of all businesses in the EU (European commission, n.d.), the need to examine and explore driving and determining factors of blockchain technology adoption by SMEs has become more substantial than ever before. To investigate these research questions, we operationalised innovation theory, which has been extensively used to examine information technology (IT) innovation adoption in organisations (Rogers, 1983), along with the theory of technology acceptance model (TAM) within the context of technological, organisational, and environmental (TOE) framework (Tornatzky & Fleischer 1990). With such a roadmap, it will help to identify the significant direct and indirect considerations and the driving and determining factors which influence blockchain technology adoption in organisations.

First, diffusion of innovation theory characterized by relative advantage, compatibility, complexity, trialability and observability. Second, TOE framework is identified by technological, organizational, and environmental context. The main objective of the TOE framework (Tornatzky & Fleischer, 1990) is to identify technological, organisational, and environmental views that influence the adoption of technology innovations in organisations. However, the assessment of the adoption of blockchain technology by SMEs covers many aspects in the social context (Oates, 2006; Recker, 2013) as well as organizational context. The interpretivist approach that is centred around humans will be helpful in addressing the people as social actors and not as objects (Oates, 2006). A viewpoint that is supported by Lee (1991) where he claims that the interpretive approach can spot the fundamental difference between empirical reality of nature and the people based on the social artifacts which is created. Furthermore, gathering data and facts are not studied only for objective interpretations and observable side of the human behaviour, rather it should entail subjectivity of the behaviour of the people themselves (Lee, 1991; Oates, 2006; Recker, 2013). Hence, data gathered will be put through a subjective interpretation to better understand what the reality can be in the social context.

The emergent result of mutually and iteratively transformational interactions between technical and social systems are continually evolving requirements of both or by designing any required changes (Lee, 2004). This transformational behaviour or new design requirements makes it hard to rely on a single system and therefore the adoption of the interpretivism paradigm try to complete the view to identify, explore, and explain all factors in a particular social context (Lee, 2004; Oates, 2006).

The thesis aims at providing SMEs across different industries an insight into blockchain technology solutions via combining TOE framework, TAM and DOI theory. The focus on these models is to study driving factors and determining factors of blockchain adoption at the organizational level. This helps SMEs to better understand the technology and its relevance for them and to easily deal with challenges surfaced during the potential adoption process of blockchain and enables them to assess their abilities to adopt a new innovative technology.

3.2 Data Collection Methods

The study can be summarized into four different phases: planning, data gathering, analysis, discussion and conclusion. The study started with the planning phase to identify purpose, goals and the selected methods. This to delimit the study and create a solid and well-thought-out research process. This was followed by an intensive selective literature review. Webster and Watson (2002) explains a high-quality review as a review that covers all the relevant literature and is not restricted to one research methodology, one set of journals, or one geographic region. However, this study follows a structured approach (Webster & Watson, 2002) to cover specifically the source materials and find out the upmost mentioned relevant applications that are related to blockchain technology. This allows us to present evidence from the literature and identify the gap that has not been addressed. Furthermore, it allowed us to build our conceptual framework that we incorporated in the research paper (Oates, 2006). Webster and Watson (2002) list three steps to conduct a structure approach: (1) the major contributions are likely to be in the leading journals, that includes conference proceedings and other disciplines such as science, economics, operations research, organization theory, and biology; (2) review the references in the main articles by going “backward”; (3) going “forward” to identify the citing articles.

3.2.1 Interviews

This thesis is a qualitative study in which interviews and literature are our main source of data collection. As stated by Recker (2013), interviews are one of the most used types of data collection for qualitative studies and can be carried out in three different ways, structured, unstructured, and semi-structured. We decided to go with semi-structured interviews for this study based on benefits in the form of flexibility (Recker, 2013) and adaptability (Patton, 2015). As mentioned by Recker (2013) the flexibility of semi-structured interviews allows us to confirm information that we acquired from the literature review while also gaining new knowledge using follow up questions, thus generating richer data. We also believe that the adaptability of semi-structured interviews was very beneficial for us, since the order of the questions and the questions themselves can be changed based on what the respondents say, which allows for a more fluid and relaxed conversation that does not jump back and forth between subjects. Recker (2013) also argues that respondents are more likely to discuss more

sensitive topics during less structured interviews which also influenced our choice for semi-structured interviews, since we argue that these sorts of technology implementations can make respondents more hesitant in divulging these sensitive topics, which could provide us with richer data. However, there were some questions that were deemed important to the study which is why it was of upmost importance that we did not forget to ask them, for this reason we opted for semi-structured interviews with the help of an interview guide to ensure that we touched upon all the important elements of the study, instead of using completely unstructured interviews.

3.2.2 Interview Guide

For our semi-structured interviews, we decided to use an interview guide, see Appendix 1. The interview guide is structured by beginning with some opening questions for our respondents. At first, we mention some ethical considerations, these will be explained in 3.4 Ethical considerations. What follows are some questions related to our respondent's background, this is to provide some context for the study, to explain to potential readers how our respondents are working or have worked with blockchain technology and their background, both academical and workwise. Following that, the real interview questions are presented which are designed based on our conceptual framework. These questions are structured under the headlines of the TOE framework, with technical, organizational, and environmental questions. These questions are of course related to the TOE framework but important aspects of TAM and DOI theory are also included under each section, as shown in our conceptual framework. Further down the interview guide we have some general questions regarding blockchain technology before presenting the finishing questions. The purpose of these interviews is to gain insight for why SMEs should consider the adoption of blockchain technology (the driving factors) and also important aspects concerning the adoption of such technologies for SMEs (the determining factors) and we feel that this interview guide is sufficient in doing just that, along with some relevant follow up questions of course.

3.2.3 Respondents

After the formation of our interview guide, we set out to find our interview subjects. This turned out to be a hard and frustrating process. For our interview subjects we wanted to find people with vast knowledge of blockchain technology while also being knowledgeable about this technology in the context of SMEs. For this reason, we narrowed down our search to either SMEs who have implemented blockchain technology themselves or organizations/people who are knowledgeable in the implementation of blockchain technology in the context of SMEs. With the use of Google, LinkedIn and news articles we searched for months after potential interview subjects who fit our requirements, but we had very little luck. We are unsure if it was due to the ongoing pandemic with COVID-19 or the lack of expertise available in this specific area or just bad luck that resulted in us finding so few interview subjects. We contacted more than 50 potential companies where a large portion didn't respond at all, and the vast majority of the ones that did respond either said that they didn't have the time or expertise in our area of research. Nevertheless, after a lot of searching we did manage to find five interview subjects who we met through four interviews (our interview with Swedbank had two interview subjects), which we felt was the bare minimum in order to complete this study. We had originally planned for at least six interviews but had hoped for eight or more in order to ensure a large amount of empirical data to base our discussion on. However due to

the circumstances we had to make do with the five respondents that we found, which can be argued to be a significant limitation of this study. Further, due to the busy schedules of some of our respondents we unfortunately had to rush through some of our interviews which meant that we had to prioritize and sometimes follow up questions had to be left out, this can also be considered a limitation to the study. Nevertheless, we are very grateful to the five respondents who took the time and agreed to be a part of this study. Four out of our five respondents are actively working with blockchain right now and have great insight into its various developments and uses for SMEs, in their respective organizations, which is good for our study. However, respondent R4 is not working with blockchain technology right now, which can be argued to be a weakness of our study in terms of validity, resulting in another limitation of this study. Nevertheless, we chose to include R4 in the study because he possessed good knowledge about blockchain and its application for SMEs, the decision was also influenced by the limited number of interviews that we managed to inquire.

In an ideal world we would have preferred to meet our respondents face to face but due to the ongoing pandemic and because of the great distance between ourselves and some of our respondents we used several different video conferencing applications to carry out our interviews. One of our respondents, respondent R5 requested that he and his organization would be kept anonymous. Our respondents are presented in table 3.1 below along with their respondent code, organization, and position. Further information about each interview is available in table 3.2.

Table 3.1: Respondent Details

Respondent code	Organization	Name	Position
R1	Swedbank	Andreas Kennemar	Technology evengelist
R2	Swedbank	Ted Scheiman	Head of partnerships (Focused on fintech)
R3	ChromaWay	Olena Burutina	Business development analyst
R4	LU Innovation	Eskil Åhlin	Business developer
R5	Foundation X (Anonymous)	Anonymous	Partner manager

Table 3.2: Interview Details

Respondent Code	Interview Type	Date	Duration
R1 & R2	Microsoft Teams Video Call	29/4 – 2021	60 min
R3	Google Meet Video Call	18/5 – 2021	44 min
R4	Zoom Video Call	5/5 – 2021	45 min
R5	Google Meet Video Call	20/5 – 2021	30 min

3.3 Data Analysis Methods

3.3.1 Transcribing

All interviews were transcribed after completion. Transcribing is the process of converting oral data into written data for use during the data analysis (Kvale & Brinkmann, 2009). This was done immediately after finishing up the interviews as recommended by Kvale and Brinkmann (2009). The transcription was carried out by first recording all our interviews with the use of an audio record application called OBS Studio which we had installed on our computers, we also used an audio record app on our phones as backup. Before starting the recording, we asked all our respondents if they felt comfortable with being recorded, they all agreed. These audio recordings were then uploaded to the Microsoft Word online transcription tool which analysed the recordings and automatically transcribed the text. This worked surprisingly well but we still had to listen through the recordings and correct mistakes that the application got wrong. We tried to keep the transcriptions as authentic as possible, these are our experts' words, and we did not want to change them. However, sometimes spoken words make very little sense in written form which is why some reformulation of sentences had to be made for readers to be able to understand the text. We also included informal words to provide better context for our readers, for example "haha" was used when a joke was made, which meant that the phrase in question should probably need to be taken at face value. All transcriptions can be found in Appendix 2-5.

3.3.2 Coding

After the transcribing of the interviews were done, we commenced the process of analysing the written data. To ease this process we used coding, which is a technique that is done to

bring structure to large amounts of written data, and to make it easier to derive implicit meanings from the text (Kvale & Brinkmann, 2009). Here we used a colour coding system to categorise the text based on the different factors from our conceptual framework, to separate the relevant from the irrelevant data. Each factor had a separate colour and abbreviation code as shown in table 3.3. We noticed that some of the highlighting colour in Microsoft Word made it difficult to read the transcripts which is why a white font text was used for the darker highlighting colours.

Table 3.3: Colour Coding for Factor Categorisation

Factor	Colour	Code
Relative advantage	Yellow	RA
Complexity	Red	C1
Compatibility	Dark red	C2
Management support	Turquoise	MS
Innovative business model	Blue	IBM
Financial and technical resources	Dark turquoise	FTR
Organizational readiness	Gray	OR
Competitive pressure	Green	CP
Stakeholder support	Olive green	SS
Consumer readiness	Dark green	CR
Market uncertainty	Pink	MU
Government pressure	Purple	GP

An example of how the how the coding was done in practise is shown in table 3.4, which shows written data from one of our responders. Here R3 talks about some of the technical benefits of blockchain technology, which is highlighted by a yellow colour, to signify that this is part of the text is concerning the “Relative advantage” factor. Further, R3 explains that although blockchain brings these benefits it also comes with some problems in terms of resources, which could be a dealbreaker for SMEs. This latter part of the response is highlighted by a grey colour, to signify that this concerns the factor of “Organizational readiness”. These two factors are also shown as their respective abbreviations of “RA” and “OR” in the code column of the transcript.

Table 3.4: Example of Colour Coding for Factor Categorisation

Row	Person	Transcribed text	Code
2.34	O	Yeah, definitely. On a certain level, yes. But as I said block-chain, although it brings a lot of positive things like I said, such as the transparency and immutability, it also carries a lot of re-source problems that needs to be resolved. And of course, that could be a deal breaker for many small to medium sized busi-nesses.	RA OR

The relevant/highlighted data was then used to present the significant findings of our inter-views in Chapter 4 Empirical Findings.

3.4 Ethical Considerations

For our empirical enquiry there are several important ethical considerations that must be ad-dressed. Before the interviews we clearly stated the purpose of the study and how the infor-mation will be used and asked for permission from the respondents before proceeding, this is something highlighted by Recker (2013) as he talks about the ethical importance of acquiring the actual permission and interests of all the participants and the promise to not misuse the data collected from them. We also ensured all our participants that they and their respective organization have the right to be anonymous and that anything mentioned in the interviews can be confidential if requested. If requested the identity of our responders would not be iden-tifiable in any way through our paper, we also asked for permission from all responders if it was okay if we recorded the interviews. This is stated by Recker (2013) as he calls it our duty to protect the rights, privacy, and sensitivity of the study participants, Walsham (2006) also touch upon is subject and mentions that he always offers confidentiality during his interviews and that the information acquired will not be revealed to other members of the organization. Recker (2013) also talks about the importance of stating that participants always have the right to be able to withdraw and having all their data deleted prior to the conclusion of the study. We share this opinion since our empirical enquiry has the potential to uncover sensitive data that the participants may not be comfortable in sharing, we also feel that when stating this to our participants it will make them more open and comfortable that in turn might gener-ate richer data. All of this was presented to our participants prior to the study.

3.5 Scientific Quality

It is argued by Jacobsen (2002) that two important steps to ensure scientific quality are valid-ity and reliability. Both can be achieved through trustworthiness of the study (Lincoln & Guba, 1985), which is why we made sure to have an accurate and transparent documentation and data collection. Below we share some more specific details about this study in the context of both validity and reliability.

3.5.1 Validity

Validity is according to Recker (2013) about the description if the data collected really measure what the researchers set out to measure. For this reason, we had the research questions in mind when designing the interview guide, further, all of the questions related to the study was based on important aspects of the literature.

However, it is argued by Jacobsen (2002) that it can be difficult to derive general conclusions from qualitative research with a limited number of interviews. This is a weakness in terms of validity for our study, since we only had 4 interviews and 5 respondents as previously mentioned, this is especially true since we did not specify on a specific industry for our research. So, it could be argued that for this reason even more interviews would be required to ensure generalizability, resulting in a significant limitation of the study.

3.5.2 Reliability

Recker (2013) defines reliability as being able to repeat a study with equal settings and get the same result. This is something that is difficult to achieve when performing qualitative research, since people opinions on subjects can vary greatly and observations can be interpreted in different ways. However, to boost the reliability of this research we have done our best to be thorough when explaining all the steps of the study, to ease the process of repeatability for future research. We have also included our interview guide and transcripts along with the coding used to analyse the findings, this to be as transparent as possible and not only include the questions asked but how we interpreted and what value we derived from the answers, to provide as much context as possible for future researchers.

Jacobsen (2002) also argues that the interview environment can play a role in affecting the reliability of the interviews. This was deemed to be especially important in these hard times with the ongoing pandemic of COVID-19. For this reason, we left the entire planning of the interviews in the hands of our respondents, which meant that they had free reign to plan when and how the interview would be carried out, to not only keep everyone safe but also to ensure that our respondents had enough time and so they could pick a communication software that they felt comfortable with.

4 Empirical Findings

The findings of our study are given and categorized in this chapter in line with the themes and elements mentioned in the thematic overview (Table 2).

4.1 Technological Context

This section derived the findings from the respondents' responses according to the questions presented in Appendix 1 under the technical subsection of the interview guide. This includes all the potential factors related to the technological context. These factors are relative advantage, complexity and compatibility.

4.1.1 Findings Associated with the Technological Advantages

When reasoning on relative advantage of blockchain technology and how it affected the decision to adopt it, all the respondents stated their perspectives and opinions of the impact the blockchain. R1 explains why SMEs move towards blockchain technology and their benefits (1.6). He claims that some companies move towards blockchain is because of its nice marketing gimmick. This could be close to R3 opinion that companies differ in the attitude towards blockchain in terms of perceiving benefits such as, innovative transparent technology that helps to streamlines and improves their business's operations, while other start-up companies would use it to attract more investors and in turn higher their profit. While R4 reason this due to curiosity that companies would experiment with a new technology to perceive its benefits (3.14) such as reliability (3.54). The second reason was mentioned by R3 that is cost effectiveness (3.14). The third reason is trust and because it is less compromised (3.14). In addition, R1 states that blockchain could solve a common problem among different entities in a trusted distributed way. therefore, it is a trusted network that share a single source of truth that you can trace, trust and store as he adds:

"That digital trust enables you to on a defined contractual basis, get a specific result regardless of if you are a company A, B or C. It doesn't really matter; all can benefit from that trusted transaction method." (1.6).

In addition, R2 mentions how blockchain certainly is beneficial in terms of traceability and its value to sustainability in the future (1.10). He focuses on the essential benefits that would be the use case of asset origin. While R3 reason the adoption of blockchain by SMEs because of its decentralized, trust, transparency and immutability (2.34, 2.42). Likewise, R5 explains these benefits from DLT point of view that it is immutable, traceable, less hackable, trusted technology and scalable (4.1). However, R1 describes that why we need digital representation of items, specifically of what so-called tokenization that will play a crucial role regarding traceability (1.11). He states:

"you can actually prove who is the owner. ... It sounds futuristic, but we're already seeing the first steps into this future." (1.11).

Moreover, R2 goes beyond that and explains how blockchain technology reduces cost of exchanging products and services within the network (1.14). Another key benefit of blockchain is smart contracts that is characterized by its "indisputable independent proof" as stated by R4 (3.20). Likewise, R5 claims that smart contracts could be attractive for some SMEs (4.7).

Meanwhile, R4 think that companies have a fear for change due to risk associated with uncertainty of the resulted performance (3.22) and the cost associated with the transformation (3.46). R4 says:

"… [be]cause they don't see the fantastic upside with it and there's a risk to change something that works." (3.22).

R5 also states that DLT can be used in trusted digital certificates across borders (4.17) or in some use cases to prevent counterfeit (4.19). Regarding SMEs, R5 claims that SMEs have to look to DLT solution as per their requirements and what fit their business regardless the complexity of the technology itself.

4.1.2 Findings Associated with the Technological Complexity and Compatibility

The factors associated with complexity and compatibility aim to investigate the degree in which these factors have an impact on blockchain technology adoption. Although blockchain can solve many issues and has several advantages over existing one, complexity and compatibility can play a crucial role of the adoption decision specially in SMEs.

R1 introduces the nature of blockchain in solving many business issues but its complexity can outweigh its benefits and create barriers of the adoption (1.6). R1 claims that:

"... now we can just share information, that is not what it's for, it usually ends up in a very complicated technology solution which binds you to a lot of bottlenecks, ..." (1.6).

Another key point of compatibility is mentioned by R1 that interoperability between blockchain and other different ecosystems due to the lack of standardization (1.11). Likewise, R3 also points out to the risk associated with the unappropriated implementation of blockchain that hinder the whole process (2.46).

That complicates the actual deployment of blockchain solutions more difficult because it is not as simple as introducing a single piece of software, rather it takes complex way of changes (1.19). further, R1 says when he was asked about top management support:

"… it [blockchain] is still a challenge to understand." (1.20)

Moreover, R3 states that even though companies perceive advantages of blockchain technology, they hardly find it easy to start their own initiatives (2.10), which support the claims about lacking knowledge and expertise in the market (2.18). However, there are several businesses that do not require blockchain and are not a suitable fit for it (2.22). As R3 argues:

"… many people just become a bit reluctant about it because they find it too hard to comprehend at some stage, … ". (2.20)

In addition, R5 explains the perception of SMEs towards blockchain that SMEs are always looking for a convenient way to solve their problem (4.7). R5 reasons this to the complexity of blockchain compared to the size of business in SMEs (4.7) and the negative perception towards blockchain technology from culture perspective (4.23).

4.2 Organizational Context

This section derives the findings from the respondents' responses according to the questions presented in Appendix 1 under the organizational subsection of the interview guide. This includes all the potential factors related to the organizational context. These factors are management support, innovative business model, financial and technical resources and organizational readiness.

4.2.1 Findings Associated with the Organizational Context

Regarding the management support, R1 claims that many managers and owners of businesses have no technical background and blockchain remains a challenge (1.21). While R5 suggest that managers should look forward to adopting such a disruptive technology in the earliest (4.33). As said by R5:

"... should be ready when there are some solutions for them or be an early adopter and create one and create a new business model." (4.33)

However, that also gives a high priority to adopt a new business model (4.33). Also, this is supported by R1 in that business model shared by multiple entities (1.27). Moreover, R1 exemplify this by giving some examples at global scale and driven by technology such as, NFTs or peer-to-peer lending system (1.29). while R3 sees that not practice for SMEs to transform their current business model into innovative one would be expensive in terms of funds and efforts (2.44). In contrast, R4 says:

"It's cheaper to do something distributed than do it centrally. … start-ups try to disrupt some of the old incumbent companies doing things in new ways." (3.14)

Another key factor in the context of SMEs is financial and technical resources. R1 explains the challenge in the existing systems and how this could impact the whole system as the change is not simple (1.19). However, R1 claims that:

"… the cost to start is much higher than the benefit you get out in financial terms." (1.29)

That also like R3 states that the cost of deploying blockchain is rather high. It is a pricey piece of technology such as, Ethereum is costly to carry out transactions (2.20). Similarly, R5 claims that each transaction is expensive (4.7). The other side of the problem is the shortage of developers and experts that can help to build blockchain apps (2.28). This opinion also supported by R5 regarding SMEs (4.29). That could be connected strongly with organizational readiness. R1 states that is hardly adopt such as, unregulated technology (1.17). Moreover, R3 claims that SMEs are easier for them to shift into blockchain solutions as they have simple infrastructure (2.24). Also, R3 claims that trainings and education are important for the

adoption of blockchain technology (2.28). R3 adds that in SMEs, resources are a dilemma that needs to be resolved (2.34). R3 says:

"… you need to really have people with a vision of blockchain, the architects who would do that and then who could implement it, the software engineers and they are really rare" (2.44)

However, R3 states that decentralized business model is not always appropriate for many industries due to its "radical change" (2.48).

4.3 Environmental Context

This section derives the findings from the respondents' responses according to the questions presented in Appendix 1 under the environmental subsection of the interview guide. This includes all the potential factors related to the environmental context. These factors are competitive pressure, stakeholder support, consumer readiness market uncertainty and government pressure.

4.3.1 Findings Associated with the Environmental Context

One of the critical factors of any emerged technology to organizations is market uncertainty. R1 claims that blockchain technology is not widely used regardless of its perceived benefits specially in Europe (1.2). He adds:

"… not that much in in the Swedish space actually …" (1.2)

Moreover, R1 states that the absence of standardization lead to put this technology in preliminary phase (1.11). R1 focuses on African countries as a solid ground for such a technology and reason that due to affordability of fees and lower cost (1.14). while in Sweden that would be related to the reliability of the current systems (R1, 1.17).

However, R1 states that blockchain has not matured yet in Europe (1.12). Regarding government pressures factors, R1 claims that financial regulation framework had developed but another one for digitization is under development for says:

"… there's one thing to digitize a share and one thing to digitize money …" (1.17)

Further, R2 reasons the slowness of the adoption process in blockchain to the need to good user case (1.22). But as R1 mentions that it will take time because it will reshape the market and rely heavily on a regulatory landscape (1.27). On the hand, customer readiness is an important role in this area as it is gradually increasing. According to R1:

"… about 1,000,000 users each week and that tells me that it's a massive speed of people entering into a technology…" (1.29).

However, although R3 does not see a negative perception towards blockchain but rather business owners should know how to benefit their businesses (2.18). Also, R3 claims that SMEs and start-ups are quite easy to get funds and invest for new blockchain technology opportunities and in turn attract a new customer segment (2.22). Besides that, it is important to work with the right partner to successfully invest in blockchain (2.24). As being said by R3:

"the resources problems sort of sorts itself out because, we as a blockchain partner we help a lot. We also invest if we see a potential in the project or in the company,"(2.26).

Additionally, R3 states that blockchain is matured enough as a technology despite the fact of the ongoing development (2.28). Meanwhile, those who need this technology is not under pressure because it is a new technology (2.36), but importantly is to remove market uncertainty by having a lot of trust and giving power and support to SMEs (2.42). while R4 claims that reaching a critical mass of blockchain is crucial (3.26). However, we noticed that respondents are agreed in opinion regarding company size as R3 claims it doesn't matter and likewise R4 (3.36, 2.52).

5 Discussion

The discussion in this chapter is in line with the themes and elements mentioned in the literature findings section. The ledger or blockchain technology is an innovation that has long been discussed and acknowledged in literature. In addition, the adoption factors are the main concerns for many businesses since it was launched in 2008 and were studied throughout the literature. However, in SMEs context, there was little found on this regard. Therefore, the present study was designed to determine the driving and determining factors of blockchain adoption by SMEs. However, blockchain is utilized to record transactions as a peer-to-peer ledger in distributed manner without a third-party provider. Blockchain has been evolved over time and gone through different stages of development, 1.0, 2.0, and 3.0.0. Such a technology might contribute to solving a larger class of economic problems in SMEs related to financial systemic risk, sustainability, governance, competitive advantage and many more. Therefore, this paper aims to assess the driving and determining factors that affect blockchain adoption through the lens of SMEs since they have a completely different economic, cultural and managerial environment (Lazarević-Moravčević, Stevanović, & Belopavlović, 2014). In the following subsections, we discuss the three conceptual themes based on the literature review and conducted interviews.

5.1 Technological Context

Although there are many reasons were mentioned from the respondents regarding blockchain adoption by organizations and specially SMEs, there are rich-information about the combinational benefits of blockchain in the literature. (R1, R3) could have the same viewpoints that some companies move towards blockchain because of assets representation, marketing and attracting purposes, while other respondents (R3, R4, R2, R5) go beyond that and states some of its top benefits such as, trust, transparent, reliability, cost effectiveness, experimenting, traceability, governance and its value to sustainability. Likewise, these findings are expected and showed through the literature review (Molinillo & Japutra, 2017; Wong et al., 2020; Kifokeris & Koch, 2019; Ilbiz & Durst, 2018; Merugula et al., 2021). In addition, one of the major characterestics of blockchain is smart contracts as described by (R4) that smart contracts is “indisputable independent proof”. Similarly, (R5) claims that smart contracts could be attractive for some SMEs. According to literature review, it shows a significant increase in the use of smart contracts characterized by trust and transparency (Bennett et al., 2021; Kifokeris & Koch, 2019; Sun et al. 2020). Moreover, they will dramatically reduce creditworthiness, cut costs, and remove trade obstacles (Merugula et al., 2021).

However, having these advantages of such an emerged technology and compare it to the risk that could result of such change, (R5) recommends that SMEs to think of the potential change as per their requirements and what fit their business. These findings confirm the association between the adoption of blockchain and challenges (Choi et al., 2020; Kouhizadeh, Saberi & Sarkis, 2021; Janssen et al., 2020). Another significant challenge stated by Merugula et al. (2021), that numerous SMEs will have is coping with growing breakthroughs in digital technology and optimization, despite the fact that huge firms always have the capacity to adapt quickly.

Other key factors that associated with complexity and compatibility have been found in the literature and acknowledged by respondents. Although blockchain can solve many issues and has several advantages over existing one, complexity and compatibility can play a crucial role of the adoption decision, especially in SMEs. (R1, R3) explain how complexity can outweigh its benefits and create barriers of the adoption. Therefore, as (R1) claims that blockchain is not easy to understand when it comes to the actual deployment. In addition, (R3) claims that it is not easy to start a new blockchain project. In accordance with these results, previous studies have demonstrated that lacking knowledge and expertise is one of the main barriers in blockchain (Choi et al., 2020; Kouhizadeh, Saberi & Sarkis, 2021; Janssen et al., 2020). This is consistent with the claims about lacking knowledge and expertise in the market mentioned by (R3). Moreover, interoperability is one of biggest barriers and challenge in the adoption process (R1), while (R3) also points out to the risk associated with the unappropriated implementation of blockchain. These results are consistent with those of Lacity, Steelman & Cronan (2019). The development of Blockchain 1.0 and 2.0, 3.0 aims to improve scalability, interoperability, and privacy. (R5) connects the complexity of blockchain with the size of business in SMEs that in most cases, SMEs are always looking for a convenient way to solve their problem. while Lazarević-Moravčević, Stevanović, & Belopavlović (2014) states that SMEs have more flexibility to adapt to changes in the environment due to its size, but any change might lead to a negative impact. This is in line with the argument that SMEs suffer from resource poverty (Thong, 2001), have less IS experience and need more external support Lazarević-Moravčević, Stevanović, & Belopavlović (2014). We argue that these perceived factors which are involved under the technological context play a crucial role that SMEs need to perceive in terms of ease of use and usefulness before address any further factors under the organizational context which will discussed in the following subsection.

5.2 Organizational Context

The factors involved under the organizational context define aspects in relation to management support, business model, organizational readiness and the potential resources. However, (R1, R5) states that blockchain adoption remains a challenge unless managers and owners have a technical background and awareness of the technology. In addition to this, they claim that managers should have a strategy and vision to adopt such a disruptive technology in the earliest. Further, (R1) explains that the new business model shared by multiple entities. (R5) suggest that managers give a high priority to adopt a new business model. While (R3) SMEs to transform their current business model into innovative one would be expensive in terms of funds and efforts. These findings may be somewhat limited by addressing the top management support and a new business model but need to be interpreted with caution since blockchain technology has been studied from management perspective. Consistent with the literature, several start-ups such as, OpenBazaar, La'Zooz, and LaborX aim at creating an alternative to "sharing economy" platforms, switching from "centralized" business models into a "decentralized" business models, to avoid relatively high transaction fees (Tumasjan & Beutel, 2019). Additionally, top management support is demonstrated through several studies (Nuryyev et al., 2020; Liu & Ye, 2021; Semenova, 2020; Barnes, Bruce & Xiao, 2019; Swan, 2019).

(R1, R3, R5) agree on that financial resources and funding could be a problematic for SMEs and the cost of deploying blockchain is rather high. While (R3) claims that SMEs and start-ups are quite easy to get funds and invest for new blockchain technology opportunities. The

other side of the problem is the shortage of developers and experts that can help to build blockchain apps (R3, R5). That could be connected strongly with organizational readiness in terms of human resources and expertise. Like what Thong (2001) argues regarding limited resources in SMEs. In addition, (R3) states that resources in SMEs are a dilemma that needs to be resolved. Moreover, (R3) claims that SMEs are easier for them to shift into blockchain solutions as they have simple infrastructure, but decentralized business model is not always appropriate for many industries due to its "radical change". However, these findings were addressed by Lazarević-Moravčević, Stevanović, & Belopavlović (2014) that SMEs have more flexibility to adapt to changes in the environment due to its size, but any changes might lead to a negative impact. Also, the respondents (R4, R3) agree that company size does not matter. However, we argue that these organizational factors can help to build the attitude towards using blockchain technology and higher the rate of innovativeness for SMEs.

5.3 Environmental Context

The factors involved under the environmental context define aspects in relation to competitive pressure, external support, consumer readiness, market uncertaint

y and government pressure. we claim that these constructs, and their potential factors have a potential impact on the adoption of blockchain technology. This means that SMEs might be able to adopt blockchain but eventually could encounter challenges due to not considering them. However, we argue that performance expectancy is one key factor that can cause competitive pressure on SMEs (Park, 2020). Further, blockchain have the potential to improve corporate governance models by increasing accuracy, accessibility, and efficiency, but such an advancement should be accompanied by matching regulatory improvements (Daluwathumullagamage & Sims, 2020). Meanwhile, blockchain is unregulated technology and that make it uncertain of adoption (R1). This issue of critical mass as mentioned by (R4), while (R1) sees this as a matter of time and SMEs will rely heavily on a regulatory landscape. These results match those observed in earlier studies (Choi et al., 2020; Daluwathumullagamage & Sims. (2020); Kouhizadeh, Saberi & Sarkis, 2021; Janssen et al., 2020). However, to be effective, blockchain standards must be adopted by a critical mass of companies (Daluwathumullagamage & Sims, 2020).

(R1) demonstrates why blockchain is not widely used in Europe and reason that its due to the reliability of the current systems. Unlike African countries, where the need to reduce the cost is mandatory and they have solid ground to build a new blockchain network. For customer readiness, (R1) claims that adoption and awareness of blockchain has increased. This is in line with (R3) who said that there is no negative perception towards blockchain. (R3) claims that is important to work with the right partners and vendors to successfully invest in blockchain. These results confirm the association between blockchain and supply chain with those of previous studies (Clohessy, Acton & Rogers, 2019; Frizzo-Barker et al., 2020; Kummer et al., 2020; Kouhizadeh, Saberi & Sarkis, 2021; Janssen et al., 2020; Niforos, 2019; Swan, 2019). Moreover, (R1, R3) are quite divided in terms of blockchain maturity, as R3 states that blockchain is mature enough despite the fact of the ongoing development. A survey from (Deloitte Insights, 2020) confirmed that blockchain maturity has increased compared to last years.

6 Conclusion

This study set out to investigate the driving factors that influence SMEs to adopt blockchain technology and to contribute insights of the determining factors surrounding its adoption, by aiming to answer the following two research questions: *What are the driving factors for blockchain technology adoption in SMEs*? *What are the determining factors that affect the adoption of blockchain technology in SMEs?*

The aim of the study was also to contribute to the body of literature to increase the understanding of blockchain technology and its relation to the IS field. An adaptation of the TOE-framework is developed to help investigate blockchain adoption by SMEs twelve operationalized constructs distributed among three contexts derived from DOI theory and the literature. Additionally, TOE-framework is expanded and integrated with TAM with three additional constructs, perceived usefulness, perceived ease of use and attitude towards adoption. There are several factors associated with each context of TOE-framework, which might have impact on the adoption of blockchain by SMEs, that were used to guide the collection of empirical data and the discussion of results.

The result of our study indicates that technological factors are the most prominent ones because of their direct influence on perceiving ease of use and usefulness of blockchain. The factors which are found in relation to technological context are decentralization, internationalization, trust, transparency, immutability, reduce operating costs, security and protection, competitive advantage, reliable networks, large market share, data integrity, cultural resistance, organization centralization; technical complexity; technological interoperability and scalability. From these factors, the factors associated with relative advantage can be considered as the driving factors of blockchain technology adoption for SMEs.

The organizational factors are highly depended on technological factors and associated with the attitude towards blockchain technology. The factors which are found in relation to organizational context are support of top management, managers personal characteristics, strategic orientation, infrastructure and resource's availability, infrastructure and resource's accessibility, firm size and expertise and knowledge. There are also several factors that belongs to environmental context and play a crucial role in the adoption of blockchain by SMEs. Furthermore, we argue that complexity and compatibility are considered barriers to SMEs in the adoption of blockchain technology. The organizational and environmental factors mentioned here along with the technological factors of complexity and compatibility can be considered as the determining factors that affect the adoption of blockchain technology for SMEs. We also argue that organizational factors can be the bottleneck of the attitude towards using blockchain technology. Additionally, the factors that found not barriers to the adoption decision but can influence blockchain adoption on the long run are environmental factors.

Although previous research is limited in studying the adoption of blockchain by SMEs, our findings indicate that SMEs required the technical and financial recourses to successfully implementing such a disruptive technology. While it is argued that blockchain technology has not matured yet. In addition, our study indicates that competitive pressure is not an influential adoption factor in organizations decision because it is an emerging technology. We also think that it has become more urgent to regulate and standardize blockchain technology to accelerate the adoption process and facilitate the use. However, we believe that blockchain's

applicability is still in its early stages, and that when its potential is realized, the competitive benefits of embracing blockchain will become clearer, potentially even making it a strategic need.

6.1 Future research

Unfortunately, this research has in our opinion been plagued with some significant limitations. The purpose of this study was to research the driving and determining factors for blockchain technology adoption in SMEs, for this to be studied to the greatest degree, we believe that a large number of organizations need to be studied, covering a wide range of industries in many regions to allow for optimal generalizability. In these regards we did not succeed due to some unfortunate circumstances. However, we still believe that the research that we have done can be very beneficial as a base for future research, with a larger empirical inquiry and study. Further, we also believe that future research on how SMEs could tackle some of these determining factors would be beneficial for the IS body of research.

Appendix 1 – Interview Guide

Opening questions:

- Is it okay if we record the interview to transcribe it?
- Do you or your company want to be anonymous? Or can we use or name and company name in the text?
- Do you want us to send a copy of the finished thesis?
- Just for context, would you mind introducing yourself, your role, company, industry and experience with Blockchain technology?
- (If not answered) How is your company working with blockchain?

Technical Questions:

- In your opinion, why are companies (specially SMEs) moving toward Blockchain technology? (Benefits and Values etc.)
- What's great about blockchain? Compared to a centralized network?
- In your opinion which industry has the most to gain from blockchain technology?
- Is there a negative perception towards blockchain technology?
- Is blockchain conceptually difficult to understand from a business or technical perspective?
- How can we accelerate blockchain-based solutions to establish a network among all societal stakeholders (companies, distributors and customers)?

Organizational Questions:

- From your perspective, how can top management in SMEs support and accelerate the adoption of blockchain technology?
- What about organizational readiness? Do SMEs have the minimum requirements of technical maturity, financial and knowledge resources to adopt blockchain?
- Is company size a key factor? If so, what are constraints regarding this?

Environmental Questions:

- What are external pressures influencing organizational adoption of blockchain technology?
- What governmental or external support is available to SMEs to adopt blockchain technology?
- In your opinion, how customers can support the adoption of blockchain technology?
- How can blockchain reduce market uncertainty?

General questions:

- What are the biggest challenges in blockchain adoption?
- What are the biggest risks when adopting blockchain?

- Technological
  - Infrastructure
  - Internet
  - Interoperability
  - Integration challenges
  - Networking
  - Reliability
  - Choice of systems
- Organizational
  - Managerial
  - Standardizing processes
  - Business model changes
  - Perceived lack of benefits
  - Security/Privacy
  - Cost factors

Finishing questions:

- Is there anything of interest that we might have missed that you think are relevant to our study?

Appendix 2 – Interview 1 (R1 & R2)

Respondent Code: R1 & R2

Organization: Swedbank

Interviewees: Andreas Kennemar (R1) & Ted Scheiman (R2)

Duration: 60 min

Date: 29th of April 2021

Andreas Kennemar = A

Ted Scheiman = T

Researchers = R

Row	Person	Transcribed text	Code
1.1	A	You are muted.	
1.2	T	One day I will learn to manage the mute button. But my name is Ted Scheiman. I'm head of partnerships, im working with different kinds of partnerships, but mostly focused on Fintechs, kind of working from the initial strategy idea phase to identify potential partners for Swedbank and then I'm responsible for the whole kind of process to bring them into the Swedbank organization and to make sure that the values are realized, whether it's customer value whether it's revenue or if it's a cost efficiency. And we also have a small investment team as part of my team as well, were we in certain cases make investments if we see that there are strategic assets as part of the partnerships. And then I can just briefly talk about blockchain as well, blockchain I can say it's not a technology that is used extensively or obviously it's used very little, within the kind of scope that I work in but we have a few cases where we use blockchains, for example in trade finance or settlement in clearing in different products. I also come across a blockchain… Typically around sustainability projects, mostly actually towards the emerging markets, yeah, uh not that much in in the Swedish space actually but it's a topic that has been coming on, I think over the last 5 years or so. And… Yeah, I think that's a little insight of myself and my exposure to blockchain at this stage.	MU RA
1.3	R	All right, thank you!	
1.4	A	And me, Andreas Kennemar, I have a role as technology evangelist. So I do work in the connection between technologies and business and also emerging technologies, not only things that already exist. I do have a background in the blockchain space. I actually started to work with	C2 RA

		cryptocurrencies in 2012 and also built companies around that so I do have hands on experience with Blockchain and both from the public and the private parts of it. I've also been the one that have maintained the blockchain perspectives within Swedbank and being responsible for overseeing those different initiatives that have been. Like Ted said it's been like having a technology that's looking for a problem to solve, which have been a bit complicated, especially when you go to traditional markets because traditional markets have tried to solve the problem in a certain way. What Blockchain introduces are some capabilities that haven't really been possible neither on the physical or the digital world and these new components require you to actually revisit the problem question from the beginning. So when evaluating… maxing trust has matured, when evaluating possible use cases for blockchain you're actually not starting with the technology itself. You do have the knowledge of what type of capabilities it gives you and what it doesn't give you because that is as important as what it gives you and then you evaluate the problem from different perspectives, so if you always dealt with a common problem in a specific way that's usually not the way to go when you're dealing with blockchain solutions, some public examples that you may have discovered yourself is trade finance. Trade finance where you have a lot of counterparties involved in the longer chain of actions and there is more of an obvious case where people that already are familiar with the process can see the benefits of having everything stored in one single truth location because that's what blockchain actually introduces it's a source of truth. It's immutable by nature and it is also traceable which means that you can actually uh from a single point of view get the same understanding as your counterpart, which hasn't been the case in the world because everybody have been using their own database or whatever cycle system usually which is not so well integrated or interconnected. So uh in those areas, you have seen uh some improvement. But uh we haven't really except from Cryptocurrencies, seen the really perfect use cases yet. In the banking sector I see cases more on for example KYC, AML, where you actually are sharing the same underlying problem. How is customer A being able to move from entity X to entity Y? Is there any possibility that you can share the underlying information which is the possible to strengthen and enhance the actual process. In northern Europe that hasn't really come that far I would say, but if you would be looking into Saudi Arabia or UAE areas, that is more of a common way of dealing with things so this technology has certain advantages and it has certain disadvantages and I'm not knowing your questions yet but a little bit of how I look at the space right now, a technology that you try to find a problem but usually you end up finding another problem you want to fix when you start digging into it. Sorry long intro.	MU C1
1.5	R	Ok, thank you! That was great! I think you touched upon some of our questions, but we'll just rehash them.	

		Maybe it comes in more detail later. Yeah. You touched upon immutability and transparency… In your opinion, why are companies especially SMEs moving towards the blockchain? Is it just these or are there other benefits would you say?	
1.6	A	Yeah, but companies are moving to blockchain for different reasons, some companies are moving to Blockchain because it's a nice marketing gimmick. Uh if you have blockchain in your name, it sounds very cool and it's very… But it doesn't really solve anything. Companies that actually try to understand what it could change, they are moving in, not only to change what's already in place, but actually to transform it to something new, and blockchain usually is not super-efficient, trying to lock it into one single entity. Yes, if you're an entity with a global reach which you see some of the larger banks in the world for example, may have use for such things but rather in combination with different entities that are related in some way they may share. They may be competitors, but they share a common problem, underlying problem. There, blockchain do have a possibility of connecting these and solving a common problem in a distributed way. Compared to having the traditional way, which we do today, like a middleman effect where somebody is the trusted party to verify every single transaction. The Blockchain is the other way around. It doesn't really matter whether there is a private or public blockchain, what matters is the way that you actually trust the participant in the network. And that digital trust enables you to on a defined contractual basis, get a specific result regardless of if you are a company A, B or C. It doesn't really matter, all can benefit from that trusted transaction method. And that's usually where people are starting, ah so let's throw, much, much more into this blockchain thing, let's store everything there because now we can just share information, that is not what it's for, it usually ends up in a very complicated technology solution which binds you to a lot of bottlenecks, so the successful projects that we can see are the ones that actually keep it as close to what it's meant for and that is by evaluating, storing and tracing transaction and based on a trusted contractual agreement, on protocol level and then benefit from those capabilities and building the logic that you need on top of it. That's why we have seen trade finance for example, all share a single source of truth. When something happens, but all the other logic is based on top of it with different types of solution. The same thing with KYC, its not that you send around a persons identification to every single entity and sharing that because it wouldn't work, for example, due to GDPR or other legislations, but rather showing a footprint that if something changes in a profile and that profile is requested by another party. You could request that type of source of information, based on that you know when it happened, who did it and that it hasn't changed. Then you can actually rely on the truth of the originating data in a different way. Sorry… do you get my reasoning here?	RA C1

1.7	R	Yeah, I think so, it was a great answer. Do you have anything to add Ted or should we?	
1.8	T	Yes, I mean, I was thinking. You started the question with why are companies moving into blockchain? Are you saying that…Do you see a big trend of companies moving into Blockchain or was it more open?	
1.9	R	It was more open, yeah, it's not like we're seeing an overwhelming trend but it's starting to grow at least. But it was more trying to characterize the benefits. Like why are some certain companies looking towards blockchain technology?	
1.10	T	Yeah, just to give a generic answer, but I see that… Like actually use cases that makes sense. Uh it's where you want to kind of produce this you know the this ability of the chain of different actions and activities, you know highlight the traceability and that's why I think it would make sense within sustainability in the future where you know, there will be demands for you know on from the customers to understand you know this financial product, you know what kind of your background or you know kind of like you know… this milk here you know where does it come from? This textile where does it come from? And I think you know that those kind of areas I think Blockchain will be essential.	RA
1.11	A	If you take a little bit more futuristic approach to it. That's most likely not where most corporation come in and work with it today. Today it currently is smaller ecosystems growing in an isolated mode, few of these are interconnected in any way like different blockchain connected to each other. They are specific and they run in a very specific way, if we take a more futuristic aspect of it, imagine that most physical things are being tokenized in a way that they actually get a digital representation. When I think physical can be almost anything like a computer, a share, something in the store, whatever you think, anything could in theory, be tokenized. Tokenization is nothing new in itself, but the problem with tokenization is how do you trust that it's actually a representation of what is really underlying, here does blockchain do play a role that you actually do, you can be able to trace the origination. We have already seen the first fragment of this called NFTs, non-fungible tokens, non fungible tokens, is a way for the corporate world also to step into this by let's say you had a piece of art and that piece of art is usually being evaluated by a middleman who tells you what the price is and then people can bid on it, once it's sold it goes to the next one and then you have the next process once somebody wants to sell or buy it, in an NFT world, you actually tie the actual painting to a token, which means that the painter itself who were the creator of it always will be represented regardless of how many more owners or sellers there has been afterwards and can get a benefit from that part of sale, which puts it back to the actual creator in a different ways, rather than just a speculative asset from the seller to the buyer so here you can see that's the start of a tokenization of assets. Imagine you would pull this into the finance world,	RA MU C2 CP

		tokenization of financial products that can actually exist and coexist in different shapes and forms in a much more different way than you actually see today. You can combine different financial products from different parts of the world and package them into something that is not possible today. But just because you share the same single source of truth system underneath, you can actually prove who is the owner. Who is the what, what the capabilities are here, etc. It sounds futuristic, but we're already seeing the first steps into this future. I would say most of this is still in the exploration phase. It's not in the space as a given standard. We don't have a blockchain standard for the world yet, like we have for TCP IP for example. But we do see the same need and we do see the same kind of development that there will be some kind of a standard and there will be interoperability who actually ties the different ecosystems together. Then we will see a much more rapid and larger transformation into a tokenization of all the different things, why tokenization? Because it actually changes the underlying problem in a different way you don't only have to trust on a blockchain you can actually look at the asset that you have and see what else could you do? How else could it be? In a digital ecosystem, so I don't… if you ask a bank, no, not there yet. Uh then we are more talking about the really, really innovation space. But if I look at the market and where it's heading that's the direction.	
1.12	T	Yeah, and if I could add something here because I read your extract of this project. You said in Sweden and then I thought okay what's the use cases in Sweden and I think futuristically speaking you know like landscape. I think if you would go to the African markets. There are a lot of these kind of ecosystems based on blockchain. I came across one just a couple of… I think like a month ago. It's called spending or something but they're doing… And I think they have a couple of million people in this kind of like blockchain community if you put it that way, what they do is that they just open a bank account at either you know the central bank or at the bank and then they have a blockchain structure with different kinds of simple products, I think you can like save money and you can lend money and then what you do is you just deposit that money to the blockchain company, they deposit it at the bank and then they earn interest. And then all the participants of this blockchain network, they can then use these tokenized coins or whatever of their real money to exchange products and services and all that. And the advantages of doing it that way is that it will be like much much cheaper than using expensive modern financial infrastructure. But I don't think… I'm fairly sure that these kind of like… You know that the that maturity in blockchain business relations won't be found in Western Europe or Europe at all. I think the most interesting use cases I have seen is actually emerging markets in Africa and so on.	RA MU
1.13	R	Yeah, it needs a market to build ecosystems from scratch and put them in one network and that's all…	

1.14	T	You need to offer something special, so in Africa people cannot afford to pay you know like 3 - 4 % on a transaction right, if you have this blockchain you know you can have much like lower costs. So, you know it needs to be a clear like value to what you're doing, back to what Andreas said, we need to solve a real problem.	CP
1.15	R	I'm just asking if this could be one of the challenges for Europe in general and Sweden especially that it's not adopted yet it's not in the fast pace as much as in other regions to be adopted. So is that because of the problem of interpretability, compatibility or complexity? So maybe you touch on some of these things but maybe if we can understand more certain reasons that it could be because of the existing infrastructure that's built for SMEs or maybe because of the complexity related to the blockchain.	
1.16	T	I mean, Andreas probably has a better view than I but I would say, Well, one of these and some.	
1.17	A	Sometimes it comes from the way how you trust your system. Also, if you look in Scandinavia, for example, we have quite high trust to our systems, so we complain about them, of course, but we actually do trust that the system works in a way. So let's say you have a bank. If you put your money in the bank you know you can get the money out. In some parts of Europe that's not the case. You don't really trust the, if we take the bank example that, uh, I don't really know if the bank will survive tomorrow and I'm not guaranteed that I will get my money out and they can freeze it at any time without my, uh, possibility of doing anything about it. Then suddenly it becomes a need for solving such situations. But that's outside of the existing framework. If you call it like that, what we do see is that regulation is on the way, I mean, there is regulation coming and there's one thing to digitize a share and one thing to digitize money. There's some different types of frameworks and rules that come into it, but if you take money for example, there are European regulation frameworks being developed now that will apply across Europe, which will introduce blockchain as the technology to be utilized by different parties. Not only the existing players, that will also overtime and sometimes that takes longer than you think and sometimes it goes quicker, but it will introduce a new infrastructure. That is built from the digital start if you say so with different characteristics, that the middleman is not present. But the rule sets will be applied to this network, what you need to do to be a compliant and fully regulated service. Was that a complicated answer or was it ok?	CP OR GP
1.18	R	Haha, it was great! Yeah, are there any hybrid solutions already exist in Sweden, because as far as I know the blockchain is compatible with… it's able to be developed to work with existing systems of the enterprise, so in this case. I think it's called Hyperledger? Is it a hybrid solution that could work for a	

		long time and then until maybe other challenges can be overcome at that time?	
1.19	A	Yeah, but I mean that comes for any type of business area really, it's not exclusive for the banks, everybody have some kind of legacy and that legacy doesn't go away just because you introduce a blockchain system, it doesn't turn overnight, so when I said earlier interoperability between blockchains is also the interoperability between the old and new they they benefit from each other and they get the disadvantages from each other as well, there are technologies like API's and so on today that you can find a unified way of communicating across. But then you have to respect the different characteristics that some of the legacy solutions is not built for dealing in such an open distributed way. Which means that the logic itself, even if it's compatible on connection level, the solution itself doesn't fully work. So, but then that is a bigger undertaking, because then you need to change a lot. And if you look at the current infrastructures many systems are tightly interconnected whether you believe it's a specific solution for something it's usually interconnected to something else. That means if you start to change in one part of the system, you usually affect other parts as well. So it's not just a, we change this and everybody is happy, usually it requires more thinking and understanding. So okay what is the upside and downside of changing that? And that also takes the actual implementation of blockchain solutions sometimes becoming more cumbersome because it's not just introducing a single piece of software and then suddenly everything works.	C2 FTR C1
1.20	R	Yeah, I see I see so uh, thank you for these answers to these questions. I think we have to maybe jump into organizational or is there anything left to ask Tom? Yeah, I think it's a good idea, so we can touch up on everything. Yeah, so let's move into organizational questions. The next questions are talking about the organizational aspects. Maybe including regulations, from your perspective how can top management in SMEs support and accelerate the adoption of blockchain technology? As you have been in the market for a long time, and you met many, many managers and encountered issues from the company represented or executives and maybe have if you can just tell us more about their attitudes towards this technology or maybe the familiarity or if they even have the ability or even knowledge about blockchain?	
1.21	A	I think from a technical perspective, no, not many still, it is still a challenge to understand, and that has probably been the most problematic for the blockchain introduction that people believe they have to understand the technology so much and they always been presented to it in a very technical way, and not that many people in managerial positions are that technical which means that you're talking a completely different language to what people are used to. We see a shift in that because what I tried to tell you for example, look at what type of capabilities it gives	C1 MS OR MU

		you. It's not the same as the technical capabilities, it's rather what type of business capabilities can you have, when that type of language and people are really starting to think of, okay so if I have this problem, I got the following options to use to solve that problem, then let's take a look at what the blockchain is, then it became less of a technical discussion and more of a business solving discussion, but I would say still there is a lot of education needs to be done. It's also the safety net of being used to a certain set up and then being introduced to a new setup. And you know that the even… It doesn't matter if you're happy or not happy with the existing setup. You know how it looks and you know how you can touch and feel it. The other thing is because there are so few cases, it makes you a bit hesitant because you think that because it knew it may not work or I don't really understand etc. And many usually fall back to what they already know about. I think it's a shift when it comes into more different type of solutions. People are getting more familiar and less worried about the technology more interested in what you're actually trying to solve. So it's still a way to go. I think most people may not even think about it because they don't really see the need for it But if you're getting it presented, a problem and you solve it in the same way as you always have solved it then it makes little sense to use a blockchain.	CR
1.22	T	Yes, and yeah, I mean, I think Andreas said most of what I had in my mind as well, but I can only add that there has been some attempts to, you know like joint projects with blockchain and to solve like major problems in the market, which was sponsored by bad management and then unfortunately those projects have not fully gone through in the way we would have wanted to so we still are like missing, you know this kind of like good user case. And I think, you know if you look at the bank with the financial markets, I think also some areas in the bank for example, it comes to like trading and you know, FX and so on. It's because of these middle hands that take a small like margin, there might be organizational resistance to provide this kind of transparency and so on. From a generic point of view, not saying that exists in Swedbank, potentially haha.	MS MU OR
1.23	A	I can also give you another angle of it. Blockchain is about sharing, you're sharing information to solve a common problem, usually that's what you want it for but that means that you sometimes have to give more than you actually get, you will have to give information to your competition for example, if that's a shared solution. That's not how companies are used to work, and sharing something that somebody else can benefit from, you rather say I invest in this and then I take all the profit for myself. If you suddenly are faced with the way that, the solution is really good, but it means that it's profitable for everyone. That's quite a hard thing to swallow for most corporations which is always used to think in the terms of what's good for us, what's good for my use case or my situation. So that's a mindset change I would say when it comes to collaboration because it is about collaboration as I said very little	IBM RA

		success of blockchain happens when you do it isolated within your own domain. Suddenly, when you start to share that's when you turn in the big problems around and say okay, it means that I might win some but somebody else is winning as well. And if it always comes down to that you will have the biggest profit most of the blockchain solutions will fail. It's because it that's not how it works, it's for the benefit of the many, not benefit for only one single party.	
1.24	R	This is the nature of the technology…	
1.25	A	Yeah! And that's what distributive technology introduces you no longer have a profitable solution in the middle taking all the benefits because people haven't been able to agree, here it changes the fact that people can agree in a digital way, but they may have to share things so somebody else is also benefiting from it, it is a different mindset.	RA
1.26	R	Maybe this is another point, which is SMEs looking for internationalization, is this related to this term, or a driving factor that maybe SMEs are looking to or working to achieve?	
1.27	A	Yeah, I mean, today, even if we it doesn't feel so right now, but we go into… the internet is a global phenomenon. It exists all over the world, but the way that corporate structures had been put in place before internet is not based on that it should be global, they are the digital companies that we see coming up today, like Google, Amazon, Facebook and they are building the digital age. They used the benefit of a distributed internet system that anybody can reach at any time. But they haven't been able to solve, there's still isolated functions in a much larger ecosystem, which you have to trust in a way, if such, for example, social media were placed on a blockchain where it actually distributed a trust across many different parties, then it wouldn't be the question whether it was Facebook who shared your information or something you would be able to control it in a different way. You wouldn't have a central entity, with blockchain being introduced to these types of networks as a layer on top of TCP IP or internet if we call it like that, then yes, some new business models will occur and corporation structures will have to change because it's not built on the same premises that there's a single entity owning it. This will take time and it will also be dependent on that the regulatory landscape around that is allowing such things to happen, because if you try to block it early on by putting too tight and everything has to fulfil what has been written in the past, then technology will just try to find another way. So this is the kind of the challenge in the game, how to treat it for what it is, and make sure that it do good things and not the bad things. That was more philosophical, but still it's worth mentioning that as well.	IBM GP
1.28	R	Yeah. Maybe if you Andreas could elaborate more on the external pressures like competitive advantages on? Maybe also economic wise?	

1.29	A	Economy wise due to Blockchain, we haven't really seen the scale effect of that. Uh I think it's similar to when you introduce most technologies that the cost to start is much higher than the benefit you get out in financial terms. Its usually when you set the first standard, when you set the first implementation, you usually pay quite a high startup cost to get it in place, and that of course is also worrisome and cause hesitation, why throw money? When we don't know that it would get profitable from day one, it is a bit short sighted maybe but it is also… I mean, corporations institutions are careful with money and don't want to throw it at anything but if you look at it in the tech space, especially now and I bring up the area of cryptocurrencies and It's complete explosion across the global scale. That benefit from the possibility of doing financial transactions without a middleman anywhere you are in the world and that monetary network has been built for 12 years now and it's proven it's alive and it's running and that is catching the interest of most organizations today because suddenly it becomes so big both in monetary terms but also in people using it, I mean, I can give you an example, Coinbase, a crypto company made their IPO two weeks ago and they are now considered as the 5th largest bank in US. It's a crypto company using blockchain technology underneath, it added, since the start of 2021, about 1,000,000 users each week and that tells me that it's a massive speed of people entering into a technology, not only the cryptocurrency, but it's a technology underneath that they are part of and that distribution is global. It is not US, it is any country that has the potential to connect to for example, Coinbase or any other exchange. That is pure technology disruption, because that means that the technology and you know we're not even talking about the blockchain here, but we're using the fundamentals of blockchain for any type of business idea on top of it, and I mentioned the NFTs, but you have so many more use cases, lending whatever it may be. It may be a peer to peer lending, everything, they all utilizing blockchain technology. It's like a base layer. So at the global scale that caught the interest of most board rooms in the world because such transformations, especially in the finance space, have never happened before. So that's something to keep an eye on because it's such a massive market and it's technology driven, but it is also driven by the demand of a different structure of what has been in place. So if it is some space I would take a look at it, it is most likely there, because there's blockchain development every single day. But it's not called blockchain. It's called something else but it still uses blockchain, which also requires you to develop blockchain.	FTR RA CR IBM CP
1.30	T	And I think you know the biggest largest use case for blockchain is cryptocurrencies and I think this is where the pressure if you can call it that comes from, it comes from the consumers, they have an interest, like many have started to invest in crypto currencies. What we see now is a lot of companies kind of like starting to bridge over the you know the family offices. You know like larger investment space into crypto currencies as well and you know you have large companies using cryptocurrency and blockchain. You know in an IPO you know these are	RA CR CP GP

		factors that are going to kind of like start making the technology widely adopted, because every time every person the buys a cryptocurrency, you know that's the first step to adoption of the technology as well in a way. And another part is, Andreas im not sure if you know this, but I read that the ECB launched like a $10 billion Ethereum kind of like bond recently and so and you know you have the Chinese digital currency, you have the Swedish e-krona. So there's a lot of things happening. So the pressure is there and it comes from the government, you know, obviously if they adopt it like that, it counts for the consumers and accounts from you know the investment community as well so yeah.	
1.31	R	Do you have experience in a government to support for companies to adopt technology or to support the ecosystems in the markets that working on blockchain technology? Or something related to regulations and the standards and stuff like that?	
1.32	A	Do you mean if the government is interested in it, or do you mean if government or what?	
1.33	R	Yeah, I mean, Uh, I don't know how it's going, how government could support the private company private sector… If you get my question…	
1.34	A	Yeah but I mean, I think it differs between different governments, how they're supporting the development of such technologies. I think there is also a knowledge curve, quite steep knowledge curve. How does this affect and what type of implication will it have for the government itself and it is also a way that government is there for some kind of control. And to be fully… You have to give up some part of the control because you're not a controlling function anymore in a distributed system. That's a challenging thing, but I do see more sandboxing participation where the tax ecosystem can get closer to regulators where they can cooperate about how the rules functions and progress of different type of solutions should be, but it differs across the globe, I would say some are more for running, let's see this as an extreme opportunity to bring talent on board and that there is a new uhm business or whatever for that country. Other see it as a threat for different reasons because they have to give up control. So it certainly is not a single unified view of that and, and that's not only about crypto currencies, it's just in general blockchain.	GP MU
1.35	R	OK, yeah, I see it's only 2 minutes left. So perhaps it's best to round it down. But I just want to say thank you so much. This was really interesting to listen to you guys and just to clarify did you want to be anonymous, your name and company or? How was your thoughts regarding that?	
1.36	A	For me, I don't care, it's not a problem.	
1.37	T	Yeah, same here.	

1.38	R	Alright that's great and do you want us to send you a copy after we're done?	
1.39	A & T	Yes please!	
1.40	R	Alright, we will do that, thank you! Bye.	

Appendix 3 – Interview 2 (R3)

Respondent Code: R3

Organization: ChromaWay

Interviewee: Olena Burutina

Duration: 44 min

Date: 18th of May 2021

Olena Burutina = O

Researchers = R

Row	Person	Transcribed text	Code
2.1	R	Maybe you could get started Mohammed and I'll just set up the recording. Yeah, OK, so just a brief description about our thesis, so we are studying the driving factors and considerations of the adoption of blockchain technology by SMEs. So we are conducting these interviews to get an understanding on the different perspectives about the technology and how SMEs could succeed when adopting this technology and I'm Mohammed and this is my classmate Tom. Yeah, so starting with the first question… Maybe we should start with… If you Olena could just briefly introduce yourself and talk a little bit about your experience with blockchain, just for context.	
2.2	O	Yeah, so I work in Chromaway. This is a Sweden based blockchain company recognized as one of the fastest growing startups in 2020. I joined fairly recently, around half a year ago and I work as a business development analyst. Which means that in my daily life I talk to a lot of potential projects, companies, startups or just simply people with ideas around blockchain that needs to be implemented and I evaluate them on how feasible the idea is, how well written the deck is, how interesting overall the role of blockchain is in this particular project. So yeah, it's all about evaluating the fit between the potential company and blockchain since most often we participate as partners, as tech partners in in a cooperation with the companies or people who want to do something on blockchain. But I've been in this field for fairly long around… So for four years now and I started with cryptocurrencies as a cryptocurrency analyst and I got a big interest in Bitcoin. Like when I was studying, so I wrote two theses, both on cryptocurrencies, one about cryptocurrency regulations and the other about blockchain based voting. So I would say	

		I have both academic perception and business perception of Bitcoin and blockchain in general.	
2.3	R	Okay.	
2.4	O	But I see that Mohammed left so...	
2.5	R	Yeah, I don't know what's what's going on with him, but maybe you can see if he's trying to join again?	
2.6	O	Uhm no. No one in the waiting room.	
2.7	R	Okay, yeah, that's that's strange, but I'll guess we'll just proceed and see if he wants to join. So if I could just maybe get your opinion like why do you think companies are moving towards blockchain technology like what's the value drivers?	
2.8	O	Uhm, well there are I would say two different types of companies that reach out to us. First the, the first group of companies are the companies that really realize the value of blockchain as a very trustworthy transparent technology that helps to make their processes smoother and they see a real true reason behind actually introducing blockchain, since it is something really innovative and something that could really improve a variety of operations and processes in their businesses, that's the first group. But we'll have also a lot of businesses and start-ups who reach out to us, they already have established businesses, or they are just starting with it and those people they just see more like a PR value of blockchain because they they've reached the, either they reached a certain level and they see that adding the word blockchain into their agenda would attract more investors, or they just starting and they feel like yes, they could survive perfectly well without introducing any of this modern innovative technologies but yeah, that it would attract more money into their projects. But hopefully the number of projects who really see the true value of blockchain is bigger, although not 100% of cases.	RA SS
2.9	R	Yeah…	
2.10	O	But I mean blockchain is just a specific type of a database, and since databases are all around us so potentially many companies and businesses could benefit from blockchain and more and more businesses realize the value of it, but they just don't know how to do it, where is the feat? How to, where to start and you know there are lots of questions, so that's why they reach out to us.	C1
2.11	R	Okay. From your point of view, what type of industry has the most to maybe gain from starting to use blockchain technology?	
2.12	O	Well, a lot. Actually, a big chunk of organizations that reach out to us are governmental organizations from all around the world, and a large part of our company is working with different governmental	

		organizations including land administration, land registry and we have some of the best experts in that field who is based in our Washington office. Uhm, so I would say that field is one of the most promising and I think many countries who are really in need for a solution to make their politics more transparent would benefit from blockchain a lot but yeah I mean if we look into industries and sectors then maybe agriculture. Since we have a big project in a Latin American Caribbean in in the field of agriculture and plantations, that would benefit from that a lot, I mean from blockchain a lot. Financial services I mean defies and rice and there are lots of really really great projects related to banking and investments and other fields and there.	
2.13	R	Construction maybe?	
2.14	O	Yeah, yeah, definitely construction as well, although maybe as a one of the partners to come to build this whole blockchain infrastructure, some of the projects. Transport logistics supply. I mean, all could be covered by supply chain probably. We have a big partner that we've invested in called Lincoln Technologies that are doing this blockchain based certificates to track products, goods, transportation all around Europe. So that's quite big as well.	
2.15	R	Okay, that's great. You only had until 10:30, right? Or?	
2.16	O	Ah yeah, more or less maybe 10:40.	
2.17	R	OK, that's good. But then we'll just, uh maybe proceed a bit, get the most important questions. How do you feel about… Is there a negative perception about blockchain?	
2.18	O	I wouldn't say there is a negative perception. I would say that many people just don't know what it is and are really new to the technology and so it's more like a suspicion based on the fact that people don't really know why and what, and you know what, how blockchain can benefit their businesses. So even if it is negative, it's not because blockchain is bad per say. But it's more like, yeah, we don't know what it is. Could you explain it in really, really easy words what they're talking about and how we're gonna do it. But yeah, now when I think about it, maybe there is some connection to Bitcoin that makes it a bit harder to actually explain that blockchain is much broader and it's not always about speculation and crypto market and the burst of the whole crypto that is much deeper than that, but I would say in the businesses it's more like yeah we don't know what we are really talking about when we talk about blockchain.	MU C1
2.19	R	Yeah, so would you say that, like the complexity is high, it's hard for maybe businesses to gain an understanding of it, and that's why it's lacking?	
2.20	O	Yes, I mean blockchain is complex. It is a technology after all. So of course it has a lot of new elements to it that is, if you really want to	C1

		understand blockchain, you need to understand it. I mean, maybe it's not necessary to know the whole thing, the whole details of how this technology is built, but yeah, many people just become a bit reluctant about it because they find it too hard to comprehend at some stage, but also implementing blockchain is rather expensive. It's an expensive technology. There are many different blockchains, for example one of the most popular ones is called Ethereum and is really expensive. It's expensive to carry out transactions and pay for gas, and I think many businesses who reach out to us at the beginning, they don't really realize that it is a complex technology, but it is also an expensive technology to implement.	FTR
2.21	R	Yeah. So how can we accelerate the process of the adoption of such technology. Maybe this concern is very important for SMEs, because of many reasons such as interorganizational partnership, like in supply chain. So in your opinion how could you accelerate this process?	
2.22	O	Yeah. I mean, I don't really know if we need to accelerate it in the way that blockchain is the future, but yet there are many industries that don't need blockchain and that its not a very good match for it. But I think we all should start with maybe education like academic education, maybe introducing courses for people, for young, for students who in the future might become the business people and build their own projects, but also introduce workshops and other informal education into, on the international level, in the organizations, talk to the governments. And yeah, just introduce what blockchain is really about based on the use cases and I think as soon as you start really diving into it and getting introduced to it, you understand all the benefits and become more inclined towards maybe researching it more, but as I said, since it's a rather expensive technology, maybe would be good if the government itself would be more friendly towards it and if the investment funds were more friendly towards it aswell. And basically those entities that could invest in blockchain projects, although I mean maybe since it's a crypto industry then if it's like a start-up who is doing something on blockchain maybe, they find the money quite easily because the market is quite heated with money and opportunities. But if we say if we talk about more traditional industries that might be harder to find financing and investments.	C2 FTR GP SS
2.23	R	Yeah, you mentioned that it's a quite heavy cost, so if we just talk about SMEs like in general, do you feel like this is something that's doable for them, are smaller and medium sized enterprises… Do they have the organizational readiness to do this kind of implementation or is it more towards larger enterprises?	
2.24	O	No, no. I mean, I think small to medium businesses and enterprises are definitely ready for blockchain and maybe it's even easier for them to shift to do blockchain because they don't have this whole broad infrastructure in place so that you really need to plan this whole shift for	OR SS

		years. So in a way it is easier and we have a lot of, I think most partners that reach out to us with their ideas are actually small to medium businesses that as I said they… Sometimes they already have a traditional business model, they have reached some level and they just look for more opportunities to attract a broader audience to attract more funds to advance their businesses with blockchain. So in a way it is easier for them. They just don't always understand the benefits of blockchain because they lack the education and maybe they don't know where to search for support and financing and resources for it. But I think as soon as they find the right partner, it becomes much easier. And of course, if the partner says that it's a right match for both parties. So yeah, it's all about actually being in the right place in the right spot and finding the right partner. And yeah, getting the right education.	
2.25	R	Okay. So the lack of resources that SMEs typically have in comparison to larger enterprises, you don't see that as that much of an issue?	
2.26	O	I think as I said, if you find a tech partner or if you find some tender that you would apply to, the resources problems sort of sorts itself out because, we as a blockchain partner we help a lot. We also invest if we see a potential in the project or in the company, so we help with the resources, and I'm pretty sure it's just about actually realizing the true potential and knowing where to search for possibilities and for resources.	SS
2.27	R	Okay. But as a technology, is it mature? I mean is it doable and can be implemented, fully implemented by any SME? Like we have a question here about technical maturity.	
2.28	O	Yeah, I mean, the technology itself is mature, although of course it's undergoing still a lot of transformations since it's been, I mean the latest version of blockchain was probably introduced with Bitcoin and Ethereum, so of course that those blockchains are not perfect and it's still you know, undergoing all these changes and improvements, and I think the problem with that is, yes blockchain is mature, but that as I said, because of the lack of education both from business side, what blockchain is about, but also from technical side, we don't have that many software developers who actually can develop a good blockchain for the companies and those developers cost a lot of money, and they're quite rare and you really need to search for them. So yeah, it's it could be on the technical side, the problem with implementation could be that you really need to spend time searching for those, software engineers who can build it.	MU OR FTR
2.29	R	Yeah. So Tom, let's move to maybe some environmental questions. Yeah, that sounds good. Yeah, So what are the external pressures influencing organizational adoption of blockchain technology? From your point of view.	

2.30	O	Can you repeat the first part of the question?	
2.31	R	What are the external pressures influencing organizational adoption of blockchain? Like maybe some reasons for the adoption of the technology, like partnerships or competitive advantage	
2.32	O	Are you asking whether they? What are the challenges that could be?	
2.33	R	Yeah maybe challenges but also what makes SMEs or companies adopt the blockchain, like reasons and the pressures for organization to adopt this technology, like competitive advantage, cost reductions or other things, is there a relationship…	
2.34	O	Yeah, definitely. On a certain level, yes. But as I said blockchain, although it brings a lot of positive things like I said, such as the transparency and immutability, it also carries a lot of resource problems that needs to be resolved. And of course, that could be a deal breaker for many small to medium sized businesses. I mean, I didn't understand fully your question, but I could. I mean, I could speak about this environmental sustainability problem or is it something else that you want me to elaborate on?	RA OR
2.35	R	I think he means like some of the external pressures that may be influencing SMEs, like for example competitors that are working with blockchains, so companies feel like oh, we should work with blockchain as well or maybe it is like something that suppliers and trading partners or entities like that, who puts pressure on companies too. Like what's the reason that they even started considering this in the first place?	
2.36	O	I don't think anyone is at this stage, where anyone is really putting pressure in terms of implementing blockchain. I mean it, since it's so new it's almost often purely a choice of the business to reach out to us and seek for more solutions like blockchain. But yeah, it, I wouldn't say the industry, the blockchain industry itself is that mature and well known that this happens quite often, at least from my perspective.	CP
2.37	R	Yeah. So maybe just a quick question. So within the literature we found some papers talking about customer support. So, customers can support the adoption of blockchain technology for SMEs?	
2.38	O	Customer support? In terms of what?	
2.39	R	I think maybe customer awareness and knowledge about the technology, is it important? Could it be urgent for SMEs to adopt this technology?	
2.40	O	Yeah, I mean, well, as I said that education is a key, so it is super important to speak about blockchains, spread the word about it. Do workshops with private sector but also governmental organizations and talk to	CR

		politician's, decision makers. Because yes, I would say that's the major challenge right now. The poor knowledge.	
2.41	R	I think you touched upon this a bit, but just maybe to summarize, how would you say? Well, how can blockchain reduce market uncertainty for SMEs? In your opinion.	
2.42	O	I mean blockchain adds a lot of trust and it makes the process much more trustworthy, and decentralized, which means that there is no central entity that controls all the operations and you know on its own whenever it, whenever it wants to alter the information or erase it from the database. So I would say the key answer to how blockchain could eliminate this market uncertainty is by having a lot of trust and giving power to even the smallest parties rather than focusing it on one central gameplayer if you want to call it like that.	RA MU
2.43	R	Okay. I'm sure you touched upon it a bit, but just to maybe summarize, your opinion on the biggest challenges that SMEs could face. You touched upon the financial costs, is there any other that you would say?	
2.44	O	Yeah, I mean it's as I said, it's a problem with financial. It's a problem with the resources. With finding the people who could actually help them realize the true potential of blockchain, and you know it's not just about reading one article about blockchain and start implementing it, you need to really have people with a vision of blockchain, the architects who would do that and then who could implement it, the software engineers and they are really rare. I mean it's of course since the industry is growing we get more and more of those people right now. But I mean it's very expensive and you really need to search for that, and I think many small to medium businesses if they are not motivated enough, they would give up because on those challenges simply because they don't know where to start and who could help them. And then realizing all this cost burden, they maybe feel like yeah their current business model would be easier to run and sustain, so I mean blockchain as a very innovative technology. It's also, you need to be ready for all these challenges related to searching for partners, talking to investors, searching for resources, money and people. And it could, maybe for the small businesses it could be too, too much of a burden, like at the end of the day if you are only oriented to make money to make for living, then maybe blockchain could seem too difficult.	OR IBM
2.45	R	OK. And also I mean it's a bit of the same, but the biggest risks you feel with blockchain?	
2.46	O	Uhm, I mean, besides those that I've already named, maybe that I think blockchain, although as I said it's basically like a type of a database and everyone uses databases, it could be a good match for every industry, yet the experience shows that it's not that it's not always the case and maybe a big risk is that blockchain will be implemented somewhere where it	C2

		shouldn't really be implemented, and then it would jeopardize the whole processes and for example, since I wrote my thesis about blockchain based voting, I came to the conclusion that maybe it's not the best use case, so uhm, simply because yes it does introduce more transparency to the process, but it also jeopardizes many centuries old democratic tradition. So it could happen with many other more traditional industries that maybe blockchain would would… Although it would bring a lot of innovativeness and maybe improve some processes, but also it would jeopardize some already well-established procedures and then yeah… We would need to figure out how to cope with that in the long run.	
2.47	R	OK, So it's a bit linked to the transparency, would you say?	
2.48	O	Yes and no, I mean, there is still a huge lobby in the different industries that maybe are not that interested in decentralizing everything, because when we talk about blockchain, we say that we decentralize the power, the knowledge, the decision making capacities to all the parties in that system, and I don't think many industries are ready for that and there is a huge lobby and a lot of money involved and it maybe it would seem like to way too radical of a change, and if we do it so too soon or too fast.	OR
2.49	R	Maybe a good example in blockchain is smart contracts, as in the case with land administration. So, do you think this is one of the top applications blockchain?	
2.50	O	I mean smart contract is not an application of blockchain support, it's the way the blockchain is implemented. So I mean I can't speak about smart contract without, I mean it comes as a whole one whole thing you write your code in blockchain in the form of smart contracts. At least from my understanding. But yeah, a smart contract and so on. Of course, it's a really cool thing, but it always comes in a package with blockchain its the way you implement it.	
2.51	R	Okay. Do you have anything else Mohammed or I could go to the last question if you don't have a… No, I think I'm done with the major questions. Then it's just, you don't have to say anything but it's just if you have anything that you think would be of interest for us in this thesis that maybe you wanted to just touch upon?	
2.52	O	Uhm yeah. I mean, a lot of talks have been made recently about the environmental unsustainability of blockchains, especially those that are the most widespread. And I think this is the biggest challenge that we need to cope with before it actually becomes like widespread and popular, a technology that is widely used in a variety of businesses, so I think a lot of blockchain companies are right now focused on addressing those	MU

		issues. But even as you see with Elon Musk, who who purchased a lot of Bitcoins to enable Bitcoin payments with his Tesla's and then he said yeah we stopped the operation because it consumed, the coin itself consumes too much energy, so yeah, I mean the technology, the potential of the technology itself is really truly great and it's a great match for all kinds of businesses, I mean and small to medium businesses as well, no exception. But there are so many challenges and it's so new still that it has a long way towards actually implementing it on a global scale.	
2.53	R	OK. Yeah, that's great. Uh, I think that's all we we have. So thank you so much for doing this. It was really great.	
2.54	O	Yeah, thank you guys.	
2.55	R	Do you want us to send you the report when we're done?	
2.56	O	Yeah, send me your thesis when you're done. I mean it's exciting to read it. I mean, it's so cool that more and more students actually want to research this, because I mean, I'm a recent graduate myself. But when I did my thesis in 2018 I was like the only one in like probably the whole country who wrote about crypto regulations and now it feels really good that more and more people actually are diving into it from academic perspective, so really proud of you guys.	
2.57	R	Thank you.	
2.58	O	We need more, we need more talented young professionals who actually are interested in blockchain.	
2.59	R	Yeah, it's very interesting! Well alright, thank you so much.	
2.60	O	Thank you guys. Yeah it was really good to talk to you and good luck with your thesis, is it a master thesis or is it bachelor?	
2.61	R	It's a master.	
2.62	O	Cool, well have a good day then.	
2.63	R	Yeah, you too, thank you! Bye.	
2.64	O	Bye.	

Appendix 4 – Interview 3 (R4)

Respondent Code: R4

Organization: LU Innovation

Interviewee: Eskil Åhlin

Duration: 45 min

Date: 5th of May 2021

Eskil Åhlin = E

Researchers = R

Row	Person	Transcribed text	Code
3.1	R	Uh, OK proceed.	
3.2	E	Alright, so as you can see my name at Eskil, it is great haha, I don't have to remember names anymore. I have a master's in computer science from the late 1990s and then I worked in the industry for many years. I also have a degree from Ekonomihögskolan actually, in handelsrätt, from a few years back and I worked several years in the Bay Area too, and done current management and writing standards and so things like that, and then the few words about LU innovation is that… We help researchers and students to realize their ideas. So, if a researcher or student has some sort of idea or some sort of concept, we help them to commercialize it and we help them with this development with patterns of necessary legal advice, investments etc. Uh, it's a one stop shop for everything, so to speak. That is a little bit about us and, but do you go ahead and explain? Your idea a little bit about yourself too, you want to start?	
3.3	R	Yeah, uh, my name is Mohammed. So, we are students in information system department in Lund University. Uh, Tom and I we have been working for many, tests and assignments in this course, and finally we are in the end with this thesis so, so this is all about me. Uhm, I had my bachelor's degree in computer science as well, but uh, so yeah go ahead Tom. Yeah, and I'm Tom Wiström. I previously studied here in Lund as well during my bachelors. I was reading systemvetenskap here at ekonomihögskolan and now I'm doing the masters with Mohammed here in Information Systems. And what we want to do, we basically want to find out why uh, companies are moving towards blockchain technology and also just deep dive into the factors affecting the adoption of blockchain technology. We are more… We have decided to go. I don't know if I included that in the email, but we have decided to maybe specialize a	

		bit on small and medium sized enterprises and see how they… Yeah, what's the difference there? And if that has any effect on the adoption and the value drivers of blockchain technology.	
3.4	E	Okay	
3.5	R	Yeah, that's pretty much it, if there's not anything I missed Mohammed? Yeah, I think, uh, this is our scope as Tom mentioned. Well, just, we study SMEs attitude towards the adoption of blockchain technology in the Swedish market, in terms of many factors.	
3.6	E	What have you done? Uh, what research methods do you do use interviews or?	
3.7	R	We use interviews and literature review.	
3.8	E	Okay, okay. Yeah, so I mean and the way I. I mean I can give my perspective, but it's not something I work with every day. Of course. Uh, or maybe I can help you by explaining some of the methods we use to when I see a new technology… I don't know how you want to, how you want my help?	
3.9	R	Yeah. We have some some interview questions that we have…	
3.10	E	Oh OK, that's OK. That's makes it easy.	
3.11	R	That that we thought we would just go through with you to see your opinions on them and see your perspective. But first, maybe you could just for context, maybe explain a bit how you have worked or researched with blockchain just for a little bit of context.	
3.12	E	Ok well blockchain is, well, I mean it came up when I was in… First I heard about it back in. 2014, 2015 sometime, uh, when it was the "the thing" in the Bay Area. I lived and worked there in the Bay Area at that time. And I worked at Sony at that time. I saw the potential in it of course, as a ledger, like as an open ledger. And there were many investments being placed in this tech in at the time and many different applications for it too. It's certainly something that has potential to change several markets, for sure, but I haven't really actively worked with it. But I know people who have, of course, but me personally. You know, I haven't worked with it actively, but as a business developer it is certainly one of those, techniques that you have to keep an eye on, like machine learning or you know cloud computing or nano tech.	
3.13	R	Yeah, definitely, okay, thank you, so based on your…What you know and your experience, what would you say are the reason that companies today are considering moving towards blockchain technology?	

3.14	E	I think, uh. I mean, I think one reason is just curiosity. To be honest. It's a new way of doing things. Uh, I think that people and companies are experimenting and trying different applications. I think another reason is probably cost effectiveness. It's cheaper to do something distributed than do it centrally. Uh, and a third thing could be trust in certain cases. I mean, it's almost impossible to break or hack the blockchain or a blockchain. So that that could be one reason too, I think, and then one reason could be to try and find new business models or also for start-ups. Try to disrupt some of the old incumbent companies doing things in new ways. So those are the reasons, I think.	IBM RA
3.15	R	Okay. Do you want to go ahead Mohammed? Yeah. Uhm, so maybe I could ask. So most most blockchain initiatives and projects in the literature review is talking about supply chains and how it's connecting all stakeholders together. So, I'm asking if you can maybe elaborate on on this from your point of view. How can blockchain technology solutions accelerate and establish a network of this of those stakeholders in the business? Uh, within the business companies, and…	
3.16	E	For supply chain specifically?	
3.17	R	…among all stakeholders, distributors and customers.	
3.18	E	I mean to me. I mean, I always compare blockchain as an open ledger where everything is recorded there. Everyone can look at it, and everyone can trust this ledger. So for in a in a sort of a supply chain situation, you want to make sure that, uh… The component for example that you ordered are exactly the same component that was sold to you in a factory somewhere so by, it could be perhaps, maybe a stamp, or maybe some sort of a digital signature or something on the components or whatever. It could be… It could be software too, to make sure that the… when a component is moved from one supplier to the next supplier that is still the same one, it is not replaced or exchanged over time, like a stamp of approval, I could say. For supply chain that's important, but also the contracts. Uh, it's managing contracts in an efficient way, so it's important to…	RA
3.19	R	You mean smart contracts?	
3.20	E	Yeah, I mean the way I've seen and looked at that is that two companies who don't trust each other, they use blockchain to sign the contracts more or less. And then have some sort of indisputable independent proof that we sign this, you can't go around it. Sort of big. That's the way I look at it. For contracts, could also, I mean, there are many, many examples where you could use blockchain. I think the problem is not to come up with ideas where to use it, the problem is, where is it so much better that I want to replace whatever I'm doing now where it doesn't give such	RA

		a big advantage so that I want to switch to it. I want to do it in this new way instead of the old way, I think that's the problem so to speak, yeah.	
3.21	R	Yeah. So is this considered a negative perception towards the technology itself or?	
3.22	E	Yeah, it's doing things. My feeling is that it's doing things in such a completely different way, a distributed way, that people are… I think that many companies are a little bit suspicious about it. And to overcome that suspicion there needs to be big upside. A really big upside otherwise there's no reason to use it. I mean, people have been talking about blockchain now for yeah, at least since 2015, 6 years now, which is a really long time in the tech world. So I think it has followed the typical hype curve, I think you have heard of Gartners hype curve. I think it's Gartner. You talk about something a lot and then it goes down in interest a little bit and then it matures basically. I think the problem has been that people aren't or companies aren't prepared to make the switch 'cause they don't see the fantastic upside with it and there's a risk to change something that works. And if that risk reward is not good enough, then the companies won't do it. They won't do it.	RA
3.23	R	Yeah, do you think there's a certain type of industry that's more likely to see these benefits or perceived benefits compared to compared to others? In your opinion.	
3.24	E	It will be anytime, anywhere where you manage a lot of transactions that have to be many, many. The number of constructions must be huge, so financial industries for example. We have many transactions that have to be reliable. It could also be, maybe something with food or something. But I think mostly financial, maybe real estate, but I don't think so. It works fine. I think different financial services. Because there are so many transactions, and they have to be secured and today the financial services are really slow and cumbersome and old, you know, it has its own style of doing things so I will. I will guess financial services which is already kind of happening with Bitcoin of course, but it could be more.	
3.25	R	Yeah… These large amount of transactions, do you think that's a maybe not necessary for a smaller or medium sized enterprise?	
3.26	E	Yeah, the way I've looked at it, is that, for blockchain to really have have an effect. I thought about that it needs to be… Something I mean, you need to. You need to reach a critical mass. If you're going to use blockchain for something everybody has to use it. Otherwise, I mean you can't sign contracts with yourself, for example. Or you can't, you know there needs to be a critical mass of users. And before you have reached a critical mass of users, you can't really use blockchain. It's like being the first person on Facebook or something you know you can't do anything with it, and and the easiest way to reach critical mass I would	MU

		say, is to… I mean historically you reach critical mass by coming up with something brand new, like a brand new service like for example a social network or Uber or something like that or if some of the big player starts adopting something like for example, Swish in Sweden or so. It's either bottom up or top down to reach a critical mass, I would say. And if you're in the middle somewhere. You know, you don't have the financial powers to or the size to push things through. And it is not really bottom up like a grassroot movement. I don't know. I mean, it's more difficult at least. And if you don't reach critical mass with block chain, it doesn't matter. It's just… You need to have a critical mass of users, at least within your industry, within your value chain. Cause otherwise what's the point right?	
3.27	R	Yeah, we have been reading a project for e-krona…	
3.28	E	E-krona yeah, yeah… that's typically top down, right, yeah?	
3.29	R	Yeah, so maybe this is once it's released to the public. I think maybe, do you think that could be a starting point to be adopted by uh, like, uh, an official financial institution?	
3.30	E	Sure, I mean, yeah, I mean something like that needs to happen, I think. The reason we're in Sweden at least, and in many other countries. The reason people stick to these old expensive banks is that trust is really important when someone manages your money. So once, otherwise people would have switched to the niche banks, right away, because it's cheaper and better, but people still use the old banks like SEB and Handelsbanken because they trust them because they trust them with their money. So a top down approach like e-krona for example, it would certainly help a lot, of course I mean that would be a game changer I would say. And maybe it's happening sooner than we think now with covid. The digitalization is speeding up tenfold, right? So it could go faster, I think. But there needs to be some, I think, for it to really breakthrough. Like I said, bottom up. Unless I mean bottom up is typically Bitcoins bottom up. No one really. You know there wasn't one central organization that's said let's do Bitcoin. It's just a bunch of guys and then more and more people have started doing it. So that's bottom up. Top down is for example e-krona. I think it's got to be one of those two to reach a critical mass. Otherwise you're stuck in no man's land.	MU
3.31	R	So maybe we could move to organizational perspective questions. Starting from top management, so from your perspective, how can top management in SMEs support and accelerate the adoption of blockchain technology?	
3.32	E	Yeah, I think, uh, they need to think like this. I mean there there's no end goal for them to push blockchain technology, unless they're a blockchain company. I mean the goal of any SME CEO or top management is to maximize the profit of that company. Is not to, you know, it's not to	MU

		adopt new technology, like blockchain. So what they have to do they have to look at the risk benefit awards to use something like this and look at their business. Can we simplify something? Can we? Can we make something more efficient? Can we save money somewhere? Can we even make money? And then they look at different technologies and different processes and methods. And if blockchain fits then they should adopt it. But it comes back to again maybe. I mean I always thought that blockchain is needed in between companies, I would say I mean within the same legal entity you would think they don't need blockchains to do something because you assume that people trust each other inside the same legal entity. I always thought about blockchain that it was something that would be useful between companies so to speak and not within a company. So, these small companies, these SME company's needs to again come to a critical mass somehow so they can start using blockchain outside, you know, in their relationship with other companies and maybe it could be that they are, if they're big enough they could start putting requirements on their supplier, perhaps, or something like that. But, they would never adopt blockchain without the good reason, a good you know risk benefit analysis and profit analysis. We can't just, blockchain in itself, it's just like any other technology enabler. There needs to be a business reason behind it, and if there isn't, then don't do it. And I think it comes back again to critical mass, it needs to be a critical mass of users for a particular blockchain application for it to take off.	
3.33	R	Yeah, just a hypothetical question. If there was a company and they they had this as you called critical mass and want to start using it, do you… What is your opinion on organizational readiness? For most SMEs, do they have the minimal requirements like technical maturity and the financial means to? Is it viable for them?	
3.34	E	Not right now, I don't think. I mean there are no, I have not seen any tools that can. I mean, blockchain itself is it's impossible to understand, almost. It's like cryptographic functions, and I mean I don't understand it. Of course not. So the question to that's the answer to that question is, are there tools good enough? I mean for example? Is there a Microsoft Exchange for blockchain, there need to be tools that the that the company can use. Like you use exchange for email or use Salesforce for us you know customer relations and so the question is more what tools are out there what tools… I don't know. I mean maybe there aren't any tools except Bitcoin money. I haven't looked at the market for some time, but what tools are out there that's got to be, that's the bigger question. I mean, that's the actual question. Not if companies are ready to use blockchain or not it. What tools are out there and if there are tools then yes they will probably be more likely to be ready at least. So look at the tools and the software tools around it. I think that's going to be really important.	OR C1
3.35	R	Yeah, is the company size considered a key factor for the adoption or?	

3.36	E	I don't think so. I don't think so. I think, yeah, I don't think the size of the company matters unless it's a huge company of course. That can put requirements on their suppliers, for example, uh, or something like that to reach a critical mass, it comes down to critical mass again, or I think so if there is something out there, for example to manage, I don't know let's say contracts and if there are tools, then the size of the company doesn't matter, I think. I mean it's not the size of the of the company matters unless it's a huge huge company. Of course, big enough to push something top down, but that's going to be like the…I don't know, I mean maybe the major… Maybe all the banks in Sweden are big enough to do something like this. They did swish, right, so you know it's similar. Also reach critical mass. It's not similar, but it's the same thinking the defined bankID also. So if you're doing top down it needs to be of that magnitude, it needs to be almost a monopoly on the market and then you have to do it market by market too.	MU OR
3.37	R	OK, so maybe we could move to environmental questions, Tom what do you think? Yeah no, it's proceed. I think it's good to jump too. So, maybe we can talk about what are the external pressures influencing organizational adoption of blockchain technology such as business, competition, trading, partner pressure, so this may be external pressures, or global pressures? How do you interpret this?	
3.38	E	I mean, I don't think you have to be global, definitely not, you don't have to launch something globally, it could be market by market for sure. I mean it could be within one country for sure. I mean it doesn't have to be… Like you brought up e-krona for example, let's just be in Sweden. It could be. It could be bigger than that it could be the EU, EU regulation perhaps or, you know it doesn't have to be global, but I think the adaptation must be really high over a short period of time, so you can reach a critical mass of course, but maybe… Yeah, it's hard to say Could also be smaller markets like maybe building and construction market or… But if things were called, I'm not sure. I'm not sure, but it doesn't have to be global. It does not have to be global, it needs to reach a critical mass within a certain market, which could be regional, could be, you know something that could be maybe food or I mean anyway you want to slice it, but it needs to reach critical mass, it comes back to that I think… Critical mass of users.	MU
3.39	R	Yeah, yeah we have a question here. What governmental or external support is available to SMEs? When adopting blockchain technology.	
3.40	E	I haven't heard of anything to be honest. It comes down to, you know talking about tools. Adoption to me is the same thing as tools you can use internally. And I mean, I guess e-krona is one example, but uhm I haven't heard anything, no yeah.	

3.41	R	Yeah… Is there anything that customers can do in in order to support the adoption for blockchain technology? Sorry Tom, maybe this is related to the critical mass of adoption?	
3.42	E	Yeah, yeah, I think so. If there is something, uh, I don't think customer walk around thinking about blockchain. Most people don't know what it is, but if there is a service or product that people like and start using it and it happens to have blockchain tech in it, then yes blockchain will be adopted. But it's not about blockchain, it's about the service or product that uses blockchain, and like Bitcoin. You know it's easy to say Bitcoin, of course, but if there is such a service then and people start using it, you will reach critical mass from bottom-up approach so to speak. But what that is, I don't know. I don't know what it is.	
3.43	R	Is there any disruptive technology so far, like the blockchain behavior nowadays, like have this happen? Does these attitudes that happens to blockchain happen to any technology, in the past?	
3.44	E	Yeah, I mean all technology… I've been in this industry for many years now and all technology goes through the same, uh evolution, so to speak. It's a hype curve. Then it goes down and then it matures and… I can't remember. It even has a name. I think I will send it to you later. It's their hype cycle or something like that from Gartner Group. It's been true for many, many years, but and it it's the same thing for machine learning or for autonomous cars. Or, you know, electric cars , or I mean, when I was your age, we talked about video conferencing like we're doing now 25 years later. You know, so, uh, they are still always the same, uh peak. And then it goes down and then goes up and matures. And blockchain certainly is a victim of that too. I mean it was super hype back in 2014, 2015 then it, you know, it died out a little bit and I think now we're seeing it. I hope at least maturing in some areas. The problem with blockchain compared with other with for example machine learning uh and some other you know hype technologies and stuff… Blockchain needs a critical mass to work. Uh, but I think that's the that's the strength of it, and it's also the weakness. But this is same, it follows the same hype cycle as everything else, there's nothing unique.	MU
3.45	R	Yeah, so if we hypothetically consider that blockchain is working for an SME. So do you think that the money that's saved by these companies are worth applying the technology and all resources consumed by SME's? Uhm, so in the other side they save money. Uh, from the transactions or making, uh this, uh, adoption to be more, uh, to take advantage in the market. Do you think this can help it or?	
3.46	E	Yeah, sure it could happen, yeah, I certainly think it's gonna happen. Yeah, I mean, just because we haven't seen it so far doesn't mean it can't happen. Of course not. I mean certainly not. But exactly where, uh… It comes down to the same question. Is it worth it? It is worth doing it, these companies… At least SMEs are doing different things right now.	MU RA

		Different processes and manufacturing and whatever they're doing services and it's kind of working for them, I guess. It's changing to a completely new mindset because blockchain is a new mindset. Is it worth it to them? It could be a, but for it to be worth it for them there are two things that need to happen, like critical mass like I said, but also the risk of switching needs to be… The cost of the risk of switching to blockchain needs to be lower than the cost to keep doing what they're doing. I mean, those are the two parameters. And exactly when that's going to happen, it's impossible to say. You know, I don't know enough, but blockchain and and risk management. I'm sorry, critical mass and risk management. Those things need to align so to speak.	
3.47	R	Yeah, I read one big article talking about blockchain and derisking and it's really useful, I think, if blockchain is really, uh, fully implemented in the market, but yeah, maybe we see this in the future.	
3.48	E	Yeah, I mean like yeah, I mean certainly certainly. Technology is weird like that. It's a big hype then nothing happens and it matures a few years later or many years later. Like video conferencing, which is 20 years old. And now we're using it fully, so it happens all the time and with blockchain certainly. I mean you talked about blockchain a lot then nothing happened and now it's slowly maturing. I think that's what's going to happen here too.	
3.49	R	Yeah, so from your point of view, is it considered a technology within industry 4 or industry 5?	
3.50	E	Uh, you mean… I mean, industry 4 is a machine automatic industry, right? Five I haven't heard about what is that?	
3.51	R	Within these technologies of industry 4, like AI and IoT.	
3.52	E	Yeah yeah yeah. I heard about that but what is five? But industry 4… It's certainly part of industry 4.	
3.53	R	So yeah, that's uh, that's great. I think we, we, we end up with the last questions to come so Tom do you have any questions? Yeah, did we mention anything about market uncertainty? Ehh, do you think blockchain can reduce market uncertainty?	
3.54	E	Yeah, I mean that's why you use it, Uh, that's the big strength of it. You have some third party you know verifying things, contracts and transactions and everybody can see it. And everyone trusts it like it's like a ledger so yeah. But for that to happen again, critical mass, enough people need to use it, but they should certainly certainly certainly. I mean, that's the big advantage of blockchain that it's something everyone can rely on. And it's undisputed because no one can hack it. They can certainly reduce market uncertainty, yeah.	MU RA

3.55	R	All right and just I'm sure you've touched on it several times, but just to maybe summarize, what would you say are the biggest challenges?	
3.56	E	The biggest challenges is to reach a critical mass in some blockchain application. Yeah, it has also so far only happened with Bitcoin and the other E currency is what I know of, that's the single biggest challenge and then the other one is that all these companies who are doing something in a certain way needs to see that there is a big enough benefit to switch to blockchain. Which is on the blockchain, there is a completely new way of thinking. It takes some time for people to get used to, I think, so those are the two challenges, I think.	MU RA
3.57	R	Ok, and then along with the same way, what are the biggest risks of the technology?	
3.58	E	The biggest risk is that, uh, the single biggest risk is that no one wants to start using it because no one else is using it. It's like chicken and egg problem. That's the thing I mean, you know? Yeah, and if you're the first mover on this, we start using blockchain and there's no one else using blockchain. It's like okay what am I doing here? Then the risk would be that you would probably have to have some sort of dual systems for a while or two way of doing things and that increases cost a lot of course. It's like, uh, yeah, another yeah. I think that's a big risk. No one wants to be first, and if your first you can run into trouble. If you are first you may be forced to do things in two ways, in the old way and in blockchain way so to speak, if your first and that could go on, you know. I mean, you still have to do business, and if you're the only one using blockchain, you still have you have to fall back to your old way of doing it. And that doubles your cost, or at least increases cost.	SS
3.59	R	Yeah, you mentioned something about uncertainty earlier. Do you think that's a risk as well?	
3.60	E	I think, yeah that's what I mean, no one wants to take the first step because it's like it's too uncertain. I think that's the single biggest risk. It is like yeah, what if I invest in this new tech and no one else is using it? Then my company will have lost money because we spent time and resources to implement blockchain and now it's only us here using blockchain. So what the hell you know that's the risk. That's why it is either bottom up or like a Big Bang top down I think.	
3.61	R	Okay, Is there anything that we missed that you think would be of interest for us in this study?	
3.62	E	No, I think it goes down to what I've said before. It's the adoption of blockchain will come down to the business need of it, of course, like I've said many times now. So, and if that if the need is there, then the tools will come and the users will come and the critical mass will come. So	

		there needs to be a need. The benefit needs to be big enough for users to want to switch. That's what it comes down to.	
3.63	R	Alright, great, thank you so much for doing this. It was really helpful. Just one, uh, do you want to be anonymous, or can we use your name and company?	
3.64	E	Yeah that’s fine.	
3.65	R	And also do you want us to send the report when we're finished?	
3.66	E	Yeah, please send in the report. I'm happy to read it.	
3.67	R	Sure, then we'll do that.	
3.68	E	All right guys, bye bye. Have a good one bye bye!	
3.69	R	Alright, thank you so much! Bye!	

Appendix 5 – Interview 4 (R5)

Respondent Code: R5

Organization: Foundation X (Anonymous)

Interviewee: Anonymous

Duration: 30 min

Date: 20th of May 2021

A = Anonymous

Researchers = R

Row	Person	Transcribed text	Code
4.1	A	And yeah, well the applications are more or less the same. We have the same cryptography behind it, it's immutable, it's not changeable afterwards. We are far more scalable than other blockchain systems by design, you see, we don't have this bottleneck of building blocks.	RA
4.2	R	Is it removable?	
4.3	A	No, no, no. Once it's in the tangle, it's not removable.	
4.4	R	Okay.	
4.5	A	Yeah, that's in the nature of the distributed ledger technologies because it's…	
4.6	R	Uh, it's common things with the blockchain.	
4.7	A	Yes, yes, that common. Okay, now you're interested in the small and medium business… And another thing, a difference from Foundation X from the ordinary blockchains is that we are a foundation. So all our software is open source, freely available on GitHub so everyone can download and use it. We don't charge for it. You don't even have to see a 30 second video before downloading. It's really free haha. So I'm a partner manager at Foundation X and what I'm seeking is broad adoption of our software. I want to have it in the wild. I want to have it in production, so I aim for the big enterprises and I aim for the big public agencies. And another blocker that we have with small and medium businesses is that the SMEs they seek for solutions and we don't have solutions. We build the infrastructure, and we build a framework for others to build solutions on it. And mostly, SMEs they ask do you have something to solve my problem? Do you have fixed software, commercial of the shelf software that I can install and that will solve my problem? And	C1 MU RA FTR

		that's not the case. But I think that applies for most of the blockchains. Most of the blockchains are not production ready, they don't have real solutions. You can send money back and forth, but more or less that's it. When you have a look at Ethereum, you have these smart contracts on top thats maybe attractive for some SMEs, but on the other hand, each transaction costs a hell of a lot of money and creates a hell of a lot of guess or what they call it, so that renders it useless for most of the applications. So what I think for your thesis, what's the point Is that blockchain technology or DLT technology at all, is not in a stage where it's ready to be applied by SMEs.	
4.8	R	Okay.	
4.9	A	Well, I don't know what you found out?	
4.10	R	Yeah, would you mind if we ask you like some questions, like your opinions on some like more specific aspects of the...	
4.11	A	Yeah, go ahead.	
4.12	R	That's great, maybe first if you, maybe just for a little bit of context, like why, what do you see as the value drivers for blockchain, just in general, like what's great about blockchain?	
4.13	A	Yeah, I will talk about DLT not especially blockchain haha. Don't get me wrong, but yeah it it's like a public key infrastructure that's accessible from everywhere to everyone. So that's the big thing. It's immutable, so everything is once it's stored, it's never mutable. It's unchangeable. And you can track the origin, so it's perfect for track and trace systems, that's a huge advantage. Makes it easier for everyone to participate, you don't have to make an account in a central system like today. And on the other hand, today I don't know how many times you changed all your passwords, because one of the holders of one of your accounts was hacked and exposed your password to the wild open. That is always a problem with a centralized system, there's a centralized point for attackers, and that's not the case with DLTs. They solved that problem and that makes it attractive for any company to use it.	RA
4.14	R	Yeah it's like no middle man or no changing any kind of data, so this is not possible in the DLT.	
4.15	A	Yeah, and you can do trustworthy transactions with untrusted participants. There is no one central point you have to trust.	RA
4.16	R	Okay. Would you say there's a specific type of industry that's more, that has more to gain from using this technology?	
4.17	A	I think there are early adopters for the technology, but my belief is that every industry will have advantages by using DLTs. There are use cases for everyone. I think the early adopters are the public like it would be	RA

		great to have a vaccination pass based on a DLT right now for everyone who passes a border that shows in the mobile and there's a certificate on the mobile, it may be represented by a QR code and the guy at the border scans the QR code and checks in the in the DLT if the certificate is signed by an authority that's trusted. That would be great right at the moment. I would like to have it.	
4.18	R	Yeah, it's very relevant with the times.	
4.19	A	Yeah, there are track and trace use cases to have a certificate of the originator of something. If you think of them… Who grew your coffee or something like that or where was the current for your car produced? Was it really, is it really green current or does it come from coal? That's a possible use case for the DLT. But, that's not for the SMEs in the first place. Of course the financial institutes due to the nature of the blockchains, who are just about sending values back and forth. But there are dozens of others. Everything that has to be certified and has non trusted players in it. I mean, that's what I think makes it the most valuable.	RA
4.20	R	Okay. And just to check like how much time can you give us? Because then maybe we should jump to the more important questions?	
4.21	A	Yeah, please jump to some. We have maybe 5 to 10 minutes more.	
4.22	R	Okay, okay. Maybe we could talk about… Like do you believe that there's a negative perception, and that's why this sort of technology is not more widespread?	
4.23	A	I mean that depends on where you are and whom you ask. I'm sitting in the middle of Germany and we have a very very bad perception of blockchain in the wild because, when you asked the grandparents or something about blockchain, they say hey you can buy drugs for it and it's for the currency of the darknet maybe. That's what they associate with it.	C1
4.24	R	Yeah.	
4.25	A	But in the professional circumstances that changes, most of the professionals, they understand that it's more than just a currency that can be used without my identity. It's not just an anonymous way to pay. It's way more than that.	RA
4.26	R	Yeah. But as big organizations, they usually will use a, you know, a permission DLT that is private network, their own network to build a new, you know blockchain or DLT ecosystems. So maybe is that related to some issues related to compatibility with legacy systems or stuff like that?	
4.27	A	Yeah, maybe it's the state of mind of what they have. The large companies they like to be in control. They like to set the rules for their	CP

		customers. I think that's the reason why they prefer to have a private system on their own. And they don't see the real advantage of permissionless systems or it's hard to argue with them because they are used, They are the data and it belongs to them. So for them, maybe it's a step back if they say no, that the data belongs to the origin to the person behind it to those who created the data and not the gathering company. I think for humanity that's a step forward. I believe it. I believe all your data, that you are creating, that does not belong to Google or Facebook, it belongs to you. It's your data, so you should decide who can use it. You should decide how it will be monetized. And not some company that gathers the data, but that's a change of mind. Actually at IOTA you can do both. You can use the public tangle or you can build up your own.	IBM
4.28	R	Okay. Like you said that these sorts of solutions are not really viable for SMEs, maybe you could elaborate a little bit on that, like you already talked about some aspects, but is it also, like organizational readiness like do they have the… Like SMEs in general, do they have the financial resources? Do they have the technical maturity or what's your thoughts on that?	
4.29	A	At least for Foundation X, where the company needs their own developers to apply the technology to their business problems. That's the lack of developers in SMEs in general. As I said an SME wants a perfect solution for their problem. They wants to install a software maybe and use it and not think about what, how could we develop such a software? And for Foundation X it's the problem or the challenge that we don't have that, and we don't produce that, that could others do. But thats also the same for large enterprises when I think about solution providers. Uhm, they are the same for larger companies. And the ordinary blockchain also don't have this solution based attempt. At least not for the SMEs. There's no accounting software that SMEs can use that utilizes some blockchain technology, it's simply not mature enough, the whole market.	FTR MU
4.30	R	Yeah. Do you think it's going to get there like in a reasonable time?	
4.31	A	I don't have a crystal ball with me haha. But personally, I hope so. Of course.	
4.32	R	Haha yeah. Just in general then I guess like what's important for top management, how can they ease an implementation?	
4.33	A	My suggestion would be to be informed, for top management like it's their job to be informed to look in the future and to think about how they could adopt the technology behind. What does it mean for their SME, for the future of their companies? So they should be ready when there are some solutions for them or be an early adopter and create one and create a new business model.	MS IBM

4.34	R	If we're low on time, maybe we should just jump to the… What do you say are the biggest challenges? It's a big question, but if you were to summarize it with these sorts of technologies.	
4.35	A	Of course it's market adoption. There I see the biggest challenge is that the technology has to be adopted by… The more the better. You see, the breakthrough of mobiles came when everybody had a smartphone. Then the real application started to evolve before it was just a mobile phone and there was not much impact. But as soon as smartphones were widely spread then the applications came in and it became so useful that we use it more than PC's these days.	MU
4.36	R	But if it had good ground to build you know blockchain or DLT applications? Do you think that it's a good starting point for this technology to be spread out? Like powerful infrastructure or stuff like that. because as far as I know, maybe from the literature that it's you know, the infrastructure itself is costly to some extent, so is that is a challenge?	
4.37	A	Maybe for blockchains but not for us, our nodes can be run on a raspberry pie haha. So the cost of 1 Bitcoin transaction equals to 600 million Foundation X transactions. So we are not costly, please spread the word haha. Yeah, others are. That's the problem of blockchain, not in general for DLTs. I know that Ethereum is working on becoming cheaper, on reducing the amount that's needed for transaction, the amount of energy. Because of the environmental impact they have. We have a green certificate actually.	RA FTR
4.38	R	That's great, that that's very relevant with Elon Musk's tweets these past days with...	
4.39	A	Haha we tried hard to get in contact with him.	
4.40	R	Yeah, Mohammed, would you say that there is an important question that we have missed?	
4.41	A	Two more minutes, okay?	
4.42	R	Maybe we can have some information about market uncertainty maybe, awareness, knowledge, experience about this technology is like good to discuss or maybe critical mass or maybe it's technical challenges. So it's big questions, actually.	
4.43	A	Haha. I will give you a general answer. All the DLTs, they depend on the mass behind. So it's critical to have a peer review of the core protocols, that's for every DLT. Because if there is something that's not 100% waterproof, then it's a catastrophe. If it gets broken, then imagine how many people have their money invested in the coins and if there's an attack that's a real catastrophe. So I think it's vital to have peer review of the core protocols for every DLT. That should be another master thesis in mathematics, who dives so deep in there and tries to attack it or	MU C1 RA

		proves that's waterproof. I think that's a very vital point for DLTs and the SMEs they don't care about such stuff, they just… It's given for them, it works, or it doesn't work.	
4.44	R	Ok thank you, do you want us to send you our thesis when we are done?	
4.45	A	Yes please!	
4.46	R	Then we will send it, thank you!	
4.47	A	Nice to meet you guys, bye.	
4.48	R	You too! Bye bye.	

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