Generating Value Through Blockchain Technology: The Case of Trade Finance

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by

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Att generera värde genom blockkedjeteknologi:
trade finance

av

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Abstract
This thesis in Industrial Engineering and Management examines which the critical success factors are for implementing blockchain technology in the context of trade finance. Blockchain is an up-and-coming technology that has yet not been implemented in many organizations. By examining which the success factors are for implementing the technology, a foundation can be provided for future implementation efforts with the hope of achieving a successful result. Furthermore, to assess if an implementation of blockchain has been successful or not, the value of it has been assessed. Through a qualitative study with interviewees from both companies acting in the trade finance industry and experts on the subject of blockchain, information could be gathered in order to confirm the theoretical framework as well as provide for new findings. The conclusion was that the most important success factors for implementing blockchain, found in the theoretical framework were: "Managing and involving stakeholders (for instance customers and suppliers)", "Clear management support/commitment/involvement of the implementation", and "Understanding of the organization in which the implementation is to take place (its strengths, needs, etc.)". The least important factors proved to be "An in depth understanding of the technology that is to be implemented; what it is and how it works", "Keeping the change communicable and transparent within the organization", and "Extensive project definition and planning". Unexpected findings were that almost all interviewees mentioned that there has to be a real need for the technology in order for it to be successfully implemented. Also, as the very nature of blockchain requires cooperation; it is important to realize that blockchain will require a higher degree of working over organizational boundaries. Another aspect that proved to be important to take into consideration is that the trade finance industry holds legacy and therefore is prone to be resistance to change, especially to a technology of such a highly disruptive character. Lastly, it is of importance to mention that the context also has to be taken into consideration; every organization is different and require different approaches when it comes to implementing blockchain technology. When it comes to how blockchain technology generates value from an organizational perspective, the most common answers were that it enhances collaboration and trust. Many identify value in the problem-solving and more decentralized mindset that blockchain brings. An unexpected finding was that the mere use of the word blockchain will create value, as this enables collaboration and investment. Other reasons given were security, transparency, automation, traceability, and decentralization. Further analysis examined the reasons behind the importance and connection of these answers.

Keywords: Blockchain, Implementation, Success Factors, Technology, Value Creation, Trade Finance, Finance Industry
Sammanfattning

Nyckelord: Blockkedja, Implementering, Framgångsfaktorer, Teknologi, Värdeskapande, Trade Finance, Finansindustrin
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A Feasibility Study Questionnaire

B Feasibility Study Questionnaire in Swedish

C Feasibility Study Key Words

D Main Questionnaire - Experts

E Main Questionnaire - Experts, in Swedish

F Main Questionnaire - Banks

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Glossary

**agile methodology** is a type of methodology that attempts to define a set of disciplines: project management, project-life cycle, team management, engineering, and delivery.

**artificial intelligence** enables computers to learn from existing data.

**bitcoin** is a type of cryptocurrency and the most known instance of blockchain use.

**block** is what a blockchain is made up of, they contain recorded transactions.

**blockchain** is a peer-to-peer digital ledger of transactions.

**blockchain consortia** blockchain networks created on a blockchain platform.

**blockchain platform** the technology behind a blockchain solution, for instance R3 Corda and Hyperledger Fabric.

**consensus protocol** states the rules which the network users should follow and makes sure that the technical criteria of validating transactions in their correct order is fulfilled.

**critical success factor** is a factor within the few areas where satisfactory results will enable successful competitive performance for the company or organization.

**cryptocurrencies** are digital currencies that uses blockchain technology.

**cryptographic hash function** is a subset of hash functions that is fundamental for modern cryptography. The function determines whether data that is supposed to stay unchanged, has been changed.

**cryptography** is the practice and study of techniques that ensures that unauthorized people cannot access data.

**database** is a collection of information that is organized so that it can be easily accessed, managed and updated.

**decentralized application** consists of back-end code that runs on a decentralized peer-to-peer network connecting users and providers directly.

**decentralized artificial intelligence** will produce autonomous decision-making. It comes into existence thanks to the collective use of blockchain and artificial intelligence.

**decentralized autonomous organization** is a complex entity conformed by building-block contracts.
**distributed ledger technology** is a consensus of replicated, synchronized, and shared data. It is a network designed as peer-to-peer as well as a consensus mechanism is required to ensure that replication across nodes occur. Blockchain is of designed based on this technology. 13, 15, 16

**enterprise resource planning** A way of trying to balance different projects’ workload by attempting to predict how much of a resource will need to be allocated on a task. 33, 43

**hash** is an algorithm that takes data of random length as input, and turns it into output of a bit-string of fixed length. 3, 19, 21

**implementation** is a specified set of activities designed to put into practice an activity or program of known dimensions. In this thesis, the building of the system is separated from the implementation process. Also, it is assumed that an issue has been identified prior to the implementation process and that the technology can be used to solve it. 1, 11, 15, 21, 26, 29, 33, 43, 52, 61, 70, 80

**industry 4.0** is the transition from centrally controlled production to decentralized aiming to increase both efficiency and product quality. 24

**lean** are techniques concerned with the untiring strive to eliminate waste and to maximize value to the customer. 13, 26, 32, 33, 69, 70, 73

**merkle root** is the final cryptographic hash of a Merkle tree, derived from all the data in a block. Used as a header of blocks. 21

**merkle tree** is a method created for structuring data which allows a large amount of data to be verified very quickly. It is also known as a hash tree. 4, 13, 15, 20, 21

**miner** is a node that wishes to confirm new entries and thus produce new blocks in the blockchain. Performs the work in a PoW based network in exchange for a reward. 13, 15, 18, 21

**node** is any electronic devices that have an IP-adress and carry a copy of the blockchain. 15, 18, 21

**permissioned network** is a network in which a limited group of actors have attained the power of checking and adding transactions to the blockchain. 13, 15, 73, 78

**permissionless network** is a network in which essentially anyone can join and create a node in order to be able to validate new entries. 3, 13, 15, 46, 78

**private key** is a key that is secret to the public. It is used to prove ownership through digital signatures or decrypt messages. 13, 15, 19

**private ledger** is a ledger that is restricted in the sense of who can retrieve the information stored on them. 13, 15, 17

**proof of Concept** used to demonstrate how feasible and practical a potential project is. 13, 39, 58
**proof of Stake** is a consensus validation mechanism for verifying blockchain transactions through running a process that selects one of the miners proportionally to the stake that they possess according to the current blockchain ledger. 13, 15, 18

**proof of Work** is a consensus validation mechanism for verifying blockchain transactions in which miners compete to add the next transaction block using a kind of randomized "leader selection" process to choose which miner issues the next block that is proportional to the computational power of each miner. 13, 15, 18

**public key** is a key that is known to the public so that anyone can use it to either decrypt or encrypt. 13, 15, 19

**public ledger** is a ledger that can be attained by anyone who wishes to access it. 13, 15

**smart contract** is a type of computer based protocol which is able to facilitate and verify the performance of a contract. Essentially, automated and self-executing contracts which only carryout given that the pre-specified conditions are met. 1, 23, 24, 30, 37, 60, 67

**use case** defines roles in a project that will contribute to a solution. 13, 35, 38, 63, 64

**value** is in this thesis derived from the definition on critical success factor; improvements in an organization’s dimensions such as financial, operational, and customer service, i.e. anything that provides a competitive advantage. 11–14, 16, 24, 26–28, 30–32, 37, 38, 45, 47, 48, 53, 54, 57–59, 61–64, 66–69, 72–78
# Acronyms

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<td>CSF</td>
<td>Critical Success Factor</td>
<td>12, 13, 26, 30, 31, 33, 34, 44, 58, 68, 70, 76, 78</td>
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<td>DAI</td>
<td>Decentralized Artificial Intelligence</td>
<td>24, 75, 78</td>
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<td>DAO</td>
<td>Decentralized Autonomous Organization</td>
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<td>dApp</td>
<td>Decentralized Application</td>
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<tr>
<td>DLT</td>
<td>Distributed Ledger Technology</td>
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<td>ERP</td>
<td>Enterprise Resource Planning</td>
<td>13, 26, 33, 34, 69, 71, 72</td>
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<td>PoC</td>
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1 Introduction

The following section aims to give the reader an introduction and background to the chosen subject. The section will also present the reader with the purpose and aim, the research questions, and the contributions and limitations of the study. Lastly, to give the reader an overview of what is to come, the chapters in this thesis are described in the thesis outline.

1.1 Background

Since the emergence of bitcoin in 2008, the technology behind it, i.e. blockchain, has gained more and more attention for its possibility to disrupt industries and ways of working (White, 2017). There has been quite a hype surrounding the technology in recent years, which is likely connected to the hype surrounding bitcoin (Furlonger, 2017). It is expected to drive more organizational changes in the upcoming decade than big data, robotics, social web, and artificial intelligence (Du, et. al., 2018). The technology is open, transparent, and secure. It can reduce the number of middlemen, automate previously paper-heavy tasks as well as automate trust, provide the one true truth (Drescher, 2017) and create traceability (Zhou et al., 2016). A blockchain is a distributed database which means that the blockchain can store and transact a wide range of data. This makes it useful in a number of areas of application, for example payments, digital assets, tax, voting, and digital identity (Drescher, 2017).

Due to the potential of blockchain and the many possible applications of it, more and more companies around the world are attempting to incorporate it in their businesses (Kumar et al., 2017). However, the record of successful implementations of the technology is not long. A study conducted by State Streets shows that most of the senior managers who took part in the study saw blockchain as the technology of the future, but few knew how to implement it (Du, et. al. 2018). Also, from the theoretical framework of this thesis, a conclusion can be drawn regarding that a lot has been written about the possibilities of blockchain but not as much has been written on the actual implementation of it. It is therefore interesting to conduct an investigation on what makes an attempt at implementing blockchain technology successful, namely brings value to the organization. An implementation is a specified set of activities designed to put into practice an activity or program of known dimensions (Fixsen et al., 2005) and requires active engagement of the adopter, more than just selecting which technology to adopt (Comin et al., 2007). Critical success factors are those "things" that should be done if an organization is to be successful (Hassa, 2007). Since this thesis is concerned with successful implementation, the framework on critical success factors was seen fit to be used. Value is in this thesis derived from the definition on critical success factors; improvements in an organization’s dimensions such as financial, operational, and customer service, i.e. anything that provides a competitive advantage (Corkindale, et al. 2013).

An initial feasibility study was conducted and resulted in the decision to focus the research on the trade finance industry, as this industry is active in their pursuit of incorporating blockchain in their businesses and have come quite far compared to other areas. In the trade finance industry, different types of transactions are central, and therefore blockchain could really have a fundamental impact on the system. The industry is heavily paper-based, has looked and worked the same for many years, and is therefore slow to adapt to new technologies. However, there is an existing will to digitalize and blockchain may be the technology that come to disrupt this industry (Chandna, et al., 2017). Therefore, this
thesis will focus on how to successfully implement blockchain technology within the trade finance industry.

1.2 Aim and Objectives

This research aims to advance the understanding of what is required for an implementation of blockchain in an organization in order to create value from an organizational perspective. The objective is to identify success factors for implementation of blockchain technology and in what way implementing blockchain creates value for an organization.

1.3 Research Questions

Given the aim and objectives, an overall research question has been formulated:

**What is required for a blockchain implementation to bring value to an organization?**

To find an answer to the overall research question, two sub-questions have been formulated:

**SQ1:** What factors are critical for a successful implementation of blockchain in an organization?

**SQ2:** What value does a blockchain create from a business perspective?

1.4 Contributions and Delimitations

The overall contribution of this thesis can be divided into theoretical and practical contributions. The theoretical contribution is to the field of blockchain as well as the field of implementation of innovative technologies. As previously mentioned, there is a lot of literature on the possibilities and potential of blockchain but less on what makes an implementation of it successful. The practical contribution is to increase KPMG’s knowledge on the matter and set the direction for their future work in the field.

This thesis is focused on pinpointing what is required for a blockchain implementation to create value for a company, by identifying the critical success factors (CSFs) for the implementation and investigating how blockchain creates value for a company. The implementation process itself, i.e. the actual technical implementation, will not be investigated. It is assumed that developing the system that is to be implemented is not part of the actual implementation process.

The gathering of data will be limited to banks that currently have or have had a will to implement blockchain technology and experts that have interest and/or experience in the field of blockchain. Thus, banks that are interested in the technology but want to observe its development from a distance for the now being will not be investigated.

The area investigated will be limited to the finance industry, as this is the area that is furthest along when it comes to implementing blockchain technology and also an area where implementing it could fundamentally change the industry. To further narrow down the scope, trade finance is used as the context, as this is an area where blockchain has a lot of potential and where multiple large blockchain consortia are currently being conducted.
1.5 Thesis Outline

The outline gives an overview of the structure of this thesis and attempts to describe the relationship between the different sections. The outline is as below.

**Section 2: Theoretical Framework - Blockchain**
Section 2 seeks to answer what blockchain is and how the technology works. A high level of technical knowledge is required to fully grasp blockchain technology and its functioning. In this thesis, the purpose of exploring blockchain on a technical level is rather to understand how it works on a basic level, to enable the analysis of its implementation. As previously stated; this thesis is concerned with implementing blockchain technology and it is assumed that developing a blockchain is not part of the actual implementation process. Therefore, the following sections seek to give the reader a good understanding of the technology, without going into too much technical details. Subjects that will be covered include; distributed ledger technology, permissioned networks, permissionless networks, public ledgers, private ledgers, consensus protocol, miners, Proof of Work, Proof of Stake, cryptography, public keys, private keys, cryptographic hash functions, and merkle trees. Then, some benefits and disadvantages of blockchain technology will be described as well as the four different stages in blockchain development. Lastly, blockchain and sustainability will be briefly touched upon.

**Section 3: Theoretical Framework - Implementation**
Section 3 aims to give the reader a better understanding of the implementation framework of different technologies and systems, including blockchain. The section covers theory on technology diffusion, which is important to have an understanding for when implementing a new technology, such as blockchain. Contingency theory concerns contextual factors that make each implementation unique and is presented as a means to deepen the analysis. As this thesis is concerned with investigating how to successfully implement blockchain technology, it is naturally also interesting to investigate why an implementation would fail. Therefore, theory on dispositional resistance to change is covered in this section. The concept of critical success factors (CSFs) is used to investigate what has to be done in order to successfully implement blockchain technology. Theory on value creation and value capture are covered as a way to provide background for the second sub-question. Theory on commonly implemented processes: agile methodology, lean philosophy, and Enterprise Resource Planning (ERP), and their CSFs are investigated as a way of investigating if these are also important for blockchain technology.

**Section 4: Blockchain in Trade Finance**
Section 4 aims to give the reader an understanding for the context that has been chosen for this thesis; the trade finance industry. This section starts off with a general view on blockchain implementation efforts in different industries to show that the finance industry is the furthest along when it comes to implementing the blockchain technology. Then, the trade finance industry is described more specifically as a way to understand its characteristics and how these may affect an implementation process of blockchain. After this, different blockchain platforms and blockchain consortia within trade finance are described as these are the current blockchain efforts in trade finance, and the interviewed banks that are currently partaking in a blockchain project are taking part in these. To finish this section, as a way of describing a blockchain implementation project’s characteristics, the terms use case and proof of concept are explored.
Section 5: Method
Section 5 describes the methodology used in this thesis. The research approach, research process, problem definition, literature review, feasibility study, and the collection of data for the main study will be described in this section. All interviewees are presented and the section also covers the methodology for the data analysis, discussion of collected data, conclusion, and research quality.

Section 6: Results
In section 6, the findings from the data collection are presented. First, the results of feasibility study are presented. The results of the main study are divided into two sub-categories based on the findings and the research question. The first category, Success Factors, pertains to answering the first sub-question: "What factors are critical for a successful implementation of blockchain in an organization?". The second category, Value Creation, answers the second sub-question: "What value does a blockchain create from a business perspective?". Under these sub-categories, the sections have been divided into the interviewees. All interviewees’ backgrounds can be found in table 4. Lastly, the results from the questionnaires are presented.

Section 7: Analysis
In section 7, the results will be analyzed. The analysis has been divided into two sub-categories based on the findings and the research questions. The first category, Success Factors, pertains to analyzing the answers to the first sub-question: "What factors are critical for a successful implementation of blockchain in an organization?". The second category, Value Creation, analyzes the results of the second sub-question: "What value does a blockchain create from a business perspective?".

Section 8: Conclusion
Section 8 aims to summarize the results and analysis section as well as the study as a whole. This section also discusses implications in the theoretical and managerial areas as well as guidelines and suggestions for future research.
2 Theoretical Framework - Blockchain

The following sections seek to answer what blockchain is and how the technology works. A high level of technical knowledge is required to fully grasp blockchain technology and its functioning. In this thesis, the purpose of exploring blockchain on a technical level is rather to understand how it works on a basic level, to enable the analysis of its implementation. As previously stated; this thesis is concerned with implementing blockchain technology and it is assumed that developing a blockchain is not part of the actual implementation process. Therefore, the following sections seek to give the reader a good understanding of the technology, without going into too much technical details. Subjects that will be covered include: distributed ledger technology, permissioned networks, permissionless networks, public ledgers, private ledgers, consensus protocol, miners, Proof of Work, Proof of Stake, cryptography, public keys, private keys, cryptographic hash functions, and merkle trees. Then, some benefits and disadvantages of blockchain technology will be described as well as the four different stages in blockchain development. Lastly, blockchain and sustainability will be briefly touched upon.

2.1 Blockchain Introduction

There is an increasing interest in blockchain technology and its potential. It is expected to drive more organizational changes in the upcoming decade than big data, robotics, social web, and artificial intelligence (Du, et. al., 2018). It can essentially be described as the new standard for securing data. It has great potential in a number of fields, for instance identity management, land management, shipping, voting, and records management to name a few. (Mundra, 2018). Blockchain is commonly known as the technology behind bitcoin, however, the technology has possibilities well beyond the financial markets (Angelis et al., 2018). There has been a large scale hype surrounding the technology in recent years, but the potential of it remains (Furlonger, 2017).

There is no community consensus on the definition of blockchain. Everyone seems to have their own definition of what it is and these definitions can vary greatly. Some, more strict, definitions argue that blockchain must fulfill certain criteria to be called blockchain whereas more liberal definitions are open to using bits and pieces of blockchain technology that are suitable in a particular case (Furlonger, 2017). As stated in the method, the authors of this thesis choose not to limit the definition of blockchain to a single one.

A blockchain is a peer-to-peer digital ledger of transactions. The transactions may be publicly or privately distributed to all users. Blockchain technology uses cryptography and a consensus mechanism to verify transactions. This ensures that the transaction is legitimate, prevents double-spending, and allows for high-value transactions in a trustless environment. (Butcher, et al., 2018)

A blockchain is made up of blocks which contain recorded transactions. The technology is centered around the use of nodes, which are any electronic devices that have an IP-address and carry a copy of the blockchain. These nodes are usually arranged in the structure of a tree, the Merkle tree. A blockchain can be viewed as a ledger of different digital transactions; who owns what, when did the transaction occur etc. No single node owns the entire ledger, the ledger is rather owned by the entire network of nodes (Adams, et al., 2017a)
2.2 Distributed Ledger Technology

The distributed ledger technology (DLT), upon which blockchain is built, creates new ways of value creation and value capture (Maull, et al., 2017). Maull, et al. (2017) further state that the DLT is created in such a way that the state of the ledger is agreed upon by the user network rather than a third party. Users are able to place digital assets, such as records, acts, and states, on the ledgers for which the record becomes transparent and auditable but is still resistant to manipulation.

2.2.1 Permissionless Networks

The network upon which the DLT is built can be either permissioned or permissionless. The permissionless and permissioned networks have different purposes and as such, also different social and political values (Boucher, et al., 2017). For the permissionless networks, essentially anyone can join and create a node in order to be able to validate new entries. There is hence no central authority needed or able to deny anyone permission to the network.

The disadvantages of the permissionless network lie in the lack of control as well as how much energy is needed to run the system. Furthermore, development of the blockchain becomes restricted due to the need for majority consensus (Adams, et al., 2017b). The structure of a permissionless network is illustrated in figure 1.

An example of a permissionless network is the bitcoin blockchain (Adams, et al., 2017b). Any cryptocurrencies that are built on a permissionless network has the advantage of being able to be independent of banks.

![Figure 1: Illustration of a permissionless network](image)

2.2.2 Permissioned Networks

While the goal of blockchain is often to achieve transparency, it is also possible to set up permissioned networks. In these networks, a limited group of actors have attained the power of checking and adding transactions to the blockchain. The permissioned network is often preferred by actors such as banks and governments as it makes the blockchain less transparent.
In **permissioned networks**, the process of determining which nodes that should have the authority to add new entries can be designed in several different ways (The World Bank, 2017). The process is predefined by the owners of the network. The level of control over the **blockchain** that is still achieved does not suppress the advantages of the **DLT**; auditing is still possible as the information on the ledgers is still transparent to anyone with permission to read it. The main disadvantage of **permissioned networks** is that a high level of trust must be placed on the actors with the permission to change entries. However, permissioned nodes do not have to make up an entire **blockchain**. The **permissioned network** is illustrated in figure 2.

![Illustration of a permissioned network](image)

**Figure 2**: Illustration of a permissioned network

### 2.2.3 Public and Private Ledgers

The ledgers, which make up the distributed network, can be either public or private, something that determines the readability of the ledger (Boucher, 2017). A **public ledger** can be attained by anyone who wishes to access it and is therefore always a permissionless ledger. **Private ledgers** are on the other hand restricted in the sense of who can retrieve the information stored on them; such predefined actors with access to read the ledgers could for example be a governmental agency or the different actors in a specific supply chain. A ledger that is public is usually so because of the intended transparency of it to the public (Killmeyer, et al. 2017). In the cases where the public trust is irrelevant, a **public ledger** is therefore not needed. A **private ledger** has advantages when the ledger’s kept information requires privacy, since there is a restriction of who can attain the information.

### 2.3 Consensus Protocol and Mining

Consensus is what is agreed upon to exist on the ledger as well as which **blocks** that make up the **blockchain**. The **consensus protocol** states the rules that the network users should follow and makes sure that the technical criteria of validating transactions in their correct order is fulfilled. The **consensus protocol** should reach the entire group of network users, which is not necessarily an easy task. (Singhal, et al., 2018)

The **consensus protocol** is constructed differently for permissionless **blockchains** than for permissioned as the technical criterias contained in it include for example entry structure
and signature confirmation. For permissioned blockchains, the consensus protocol contains information on which actors are allowed to initiate entries and the blocks entered have to be validated by all or at least the majority of the network in order to be accepted into the blockchain. These validated nodes are thereafter known as ‘validators’. For permissionless blockchains, no authority is needed to initiate transactions or to suggest new blocks (Adams, et al., 2017b). The nodes that wish to confirm new entries and produce new blocks in the blockchain are known as miners. If after having built a new block containing these entries, this blockchain proves to be the longest - it will be valid as well as accepted (European Central Bank, 2017). A small fee for miners might exist in order to encourage miners to attempt to include their transaction in the next block and this fee will increase if there are several competing transactions (Maull, et al., 2017).

2.4 Proof of Work and Proof of Stake

Proof of Work (PoW) is together with proof of Stake (PoS) two common consensus validation mechanisms for verifying blockchain transactions. In PoW, miners compete to add the next transaction block of a blockchain by solving a complex cryptographic puzzle (Butcher, et al., 2018). This is computationally challenging, as the process requires high levels of computing power and processing time. The PoW is generated by repeatedly running one-way cryptographic hashing algorithms until a string of numbers that satisfies a predefined but arbitrary condition is produced (The World Bank, 2017). This system is built to avoid the 51% attack; an attacker must control 51% of the computing power in the system before they can generate the longest blockchain by constructing fraudulent transaction records (Liao et al., 2017).

The high energy consumption required by the PoW has resulted in the need for different methods, thus bringing forward PoS (David, et al., 2017). In PoS, miners invest digital coins in the blockchain network, representing their stake in the block (Butcher, et al., 2018). It is less energy consuming than PoW but will provide similar guarantees. PoW uses a kind of randomized "leader selection" process to choose which miner will issue the next block. This selection process is proportional to the computational power of each miner. PoS instead runs a process that selects one of the miners proportionally to the stake that they possess according to the current blockchain ledger. However, there are some technical challenges involved in realizing this technique (David, et al., 2017). This method is also designed to avoid 51% attacks, as it is believed that people with more stake would be less likely to attack the system (Chen, et al., 2018).

2.5 Cryptography

As previously mentioned, the PoW is generated by running one-way cryptographic hashing algorithms (The World Bank, 2017). According to Drescher (2017), the main idea behind cryptography is to prohibit unauthorized people from accessing data. This is done through the use of keys. The keys consist of long strings of characters (Stamp, 2016). Encryption is the digital equivalent to locking and decryption is the digital equivalent to opening a lock. Encrypted data is called cypher text, and looks like a random collection of letters and figures. Cypher text is only useful to the person who knows the key necessary to decrypt it (Drescher, 2017). In figure E, the process of encrypting the original data to a cypher text, and then decrypting the cypher text back to the original data is illustrated.
Cryptography can be divided into symmetric cryptography and asymmetric cryptography. Symmetric cryptography means that the same key is used to encrypt and decrypt the data. This means that the person that encrypted the data can also decrypt it (Drescher, 2017). The issue with symmetric cryptography is key distribution; the sender has to give the receiver the key. To make sure that no one else can see and use the key, a secure channel has to be used. There are many situations when this is not possible, for example in e-commerce (Franco, 2015). Asymmetric cryptography uses two different keys: one for encryption and another for decryption. When using asymmetric cryptography, the keys are typically called private key and public key (Drescher, 2017). The two keys are mathematically connected, and it is impossible to derive one key from the other (Stamp, 2006). There are two ways in which the keys can be used: private to public or public to private (Drescher, 2017).

2.5.1 Public to Private

The usage of keys when it concerns public to private is similar to a mailbox; anyone can put letters into it, but only the owner can open it and take them out. The information flows from the public key, where it is encrypted, to the private key, where it is decrypted. Private to public is used to send information in a secure way. Blockchain uses this approach to identify users or user accounts and to transfer ownership between them. Account numbers in a blockchain are actually public keys. Everyone can send messages to it, but only the owner can open it (Drescher, 2017).

2.5.2 Private to Public

When the keys are used as private to public, the information flows from the private key, where it is encrypted, to the public key, where it is decrypted. This way only the owner of the private key can send messages but everyone that has the public key can open it. It can be seen as a public news board where only the owner can post messages but anyone can read them. This way of using the public and private keys is used to prove ownership or authorship, as only the person with the private key could have created the message (Drescher, 2017). Blockchain uses this approach to authorize transactions, this is called a digital signature. The receiver can use the public key to validate the digital message and see that it is sent from the person who claims to have sent it (The World Bank, 2017).

2.6 Cryptographic Hash Functions

According to Drescher (2017), cryptographic hash functions (CHF) is a subset of hash functions and is fundamental for modern cryptography. Hash functions transform any kind of data into a number of fixed length, regardless of the size of the input data. The output is called the hash value and is always the same for the same input data. It only
takes one piece of data at a time as input and creates a hash value based on the bits and bytes that make up the data. The goal is to determine whether data that is supposed to stay unchanged has been changed. It creates digital fingerprints for any kind of data quickly. It is deterministic, pseudorandom, non-reversible and collision resistant. Collision resistant means that the hash function has a very low probability for returning the same hash value more than once. In figure 4, step 1 represents a valid hash reference. The box is some data that is supposed to stay unchanged and the circle labeled R1 is a valid hash reference. The arrow shows that the reference is functioning properly. Step 2 shows a broken or invalid hash reference; it depicts that when the data changes, the reference is no longer functioning properly. Step 3 shows how a new reference has to be created to fit the new data.

Figure 4: Schematic illustration of valid and invalid hash references

2.7 Merkle Tree

The Merkle tree (also known as the hash tree) is a method created for structuring data which allows a large amount of data to be verified very quickly (Komodo, 2018). By considering each input to be a leaf on the Merkle tree, the hashes of said inputs become the branches of the tree. Until all hashes are computed, the process will continue. The Merkle tree is illustrated in figure 5.

Figure 5: Illustration of the Merkle tree
Drescher (2017) states that if one transaction in the blockchain is altered with, then both the block byte string (the bytes that make up the block) and the hash have to be updated. Due to this, the nodes need to keep the entire block byte string in memory and in order to verify that a certain transaction belongs to a block, the whole block must be available. Only when this is fulfilled, the hash is possible to compute. The Merkle tree is a binary data structure where hashes are hashed in succession to produce the Merkle root.

Following the computation of the Merkle root, the block header can be computed. The block header carries the hash of the blockchain’s previous block, the Merkle root of the transactions, as well as the nonce produced by the miner. Nonce is a number only used once which is added to a hashed block so that the hash of the block is either less than or equal to the current value of the network. The transactions are comprised in the hash through the Merkle root.

The Merkle tree has several advantages, the foremost is its power in transaction verification. It is not necessary to run the entire blockchain in order to be able to confirm a transaction as the nodes can maintain only the required part of the blockchain but are also able to request information from the full blockchain should it be necessary.

2.8 Benefits and Disadvantages of Blockchain Technology

Blockchain technology has many potential long-term benefits, as well as a few disadvantages. In table 1, some of these benefits are described and in table 2, some disadvantages are described (Drescher, 2017).

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disintermediation</td>
<td>The blockchain will replace the old role of the middleman with itself as a digital and strictly rule-following middleman. It will replace a human organization that relies on the trust of its customers with a software system that encodes trust (Drescher, 2017).</td>
</tr>
<tr>
<td>Automation</td>
<td>The blockchain will replace manual tasks (typically performed by middlemen) by automated interactions between peers (Drescher, 2017).</td>
</tr>
<tr>
<td>Standardization</td>
<td>Blockchain is based on the existence of rules and standards that cannot be altered, and therefore provide trust (Drescher, 2017).</td>
</tr>
<tr>
<td>Streamlining Process</td>
<td>As a result of standardization and automation, processes will be more streamlined and transparent (Drescher, 2017).</td>
</tr>
<tr>
<td>Increased Processing Speed</td>
<td>Implementation of blockchain technology will result in a faster process, as the blockchain may replace time-consuming manually performed tasks (Drescher, 2017).</td>
</tr>
<tr>
<td>Cost Reduction</td>
<td>As a result of the increased processing speed, the increase in automation, standardization and reduction of middlemen, costs will be reduced (Drescher, 2017).</td>
</tr>
</tbody>
</table>
The data can not be tampered with or forged and the technology hence helps to protect the security and privacy of data (Zhou et al., 2016).

A public list allows for each transaction made to be accessed and viewed by everyone in the network, making the network transparent and the transaction traceable (Zhou et al., 2016).

<table>
<thead>
<tr>
<th>Disadvantage</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of privacy</td>
<td>Public blockchains do not hide any of their data, everyone is able to read the whole history of transactions. This is an issue as everyone may not want to share their data (Drescher, 2017).</td>
</tr>
<tr>
<td>Loss of personal responsibility</td>
<td>This is often a result of disintermediation (Drescher, 2017).</td>
</tr>
<tr>
<td>Loss of jobs</td>
<td>A result of automation and standardization (Drescher, 2017).</td>
</tr>
<tr>
<td>High energy consumption</td>
<td>A blockchain potentially requires a large amount of energy to run (The World Bank, 2017).</td>
</tr>
</tbody>
</table>

2.9 Stages in Blockchain Development

The different kinds of blockchain technologies and uses can be characterized by four stages, where the first three are already fairly established and the fourth is yet to come. These stages have developed on each other. However, this does not mean that an organization that wants to implement blockchain technology must follow the stages in their order (Angelis et al., 2018). In the following sections, the four stages of blockchain development will be explored as to develop an understanding of how blockchain is used today and can potentially be used in the future.

2.9.1 Blockchain 1.0: Decentralized Consensus

Blockchain 1.0 reduced transaction costs as it got rid of the need for middlemen such as a central authority for validating and securing transactions. Bitcoin is a type of blockchain 1.0, along with other cryptocurrencies (Angelis et al., 2018).

Bitcoin is a digital currency that is not regulated by any person, institution, or government. This lack of control results in a highly volatile behaviour. Its value depends only on expectations and social convention. Sometimes, for "regular" currencies, governments increase their monetary supply to solve pressing short-term financial problems which then leads to high inflation. Since Bitcoin is not controlled by any governmental monetary policy, this cannot happen. Bitcoin is a distributed digital currency based on a peer-to-peer
network of computers running the network, meaning there is no central server where bitcoin is running. It is open-sourced, meaning that anyone can access its code and try to create their own cryptocurrency using the bitcoin code. (Nakamoto, 2008)

2.9.2 Blockchain 2.0: Smart Contracts

According to Adams, et al. (2017a), smart contracts are a type of computer based protocols which are able to facilitate and verify the performance of a contract. They are essentially automated and self-executing contracts which only carry out given that the pre-specified conditions are met. This increases the speed, efficiency, and trust that the contract is completed as should and there is no need for a third-party resolution.

The smart contract is a blockchain transaction which extends further than the simple buy/ sell transaction. It features the same kind of agreement that is set up for any contract - two or more parties agree on doing something in the exchange for something - but removes the need for trust between the partners. One can compare the smart contract to how a vending machine, or any algorithmically operable machine, operates: the set instructions will be followed every time in every case. Essentially, the smart contract follows "code is law". (Manski, 2017)

The problem with smart contracts lies in the need for flexibility with contracts as well as the question of individuals' free will. The smart contract is indeed set up to carry out the agreement arranged between two or more parties, but the process of ensuring equity and verifying that the contract is error-free will require new rules and procedures (Manski, 2017). A possibility is to simulate the smart contract in order to see how it will work in unexpected situations. The process of smart contracts is illustrated in 6.

Manski (2017) further states that it will be nearly impossible to control the smart contract using existing law, such as suing for damages, and will require that the parties agree on incorporating the legal framework in the code. The contract in itself does not enable previously impossible tasks, but rather works to eliminate existing common problems by eliminating the human judgment and allowing complete automation.

The smart contract has the possibility of redefining how the economy is set up, possibly even redefining how firms work (Maull, et al., 2017). Smart contracts can be recorded onto blockchain, whereas users can perform simple tasks (Kumar, et al., 2017). These building-block contracts can thereafter conform into more complex entities, usually known as decentralized autonomous organizations (DAOs).

![Figure 6: Step-by-step how a smart contract works](image)
2.9.3 Blockchain 3.0: Decentralized Applications

According to Angelis et al. (2018), decentralized applications (dApps) consist of back-end code that runs on a decentralized peer-to-peer network connecting users and providers directly. Dhillon, et. al. (2017) states that the dApp is a new type of application that builds on features such as immutable record-keeping and network-wide consensus. According to Dhameja, et. al. (2018), a decentralized application is an application that interacts with blockchain. The dApp is created as a way of making use of the database that blockchain is and retrieve data. These applications do not rely on a centralized database and there is no single point of failure or control. Dhameja, et. al. (2018) explains the dApp using the supply chain process for manufactured goods as an example: each vendor would need to have a blockchain node set up so that they can participate in the consensus process on the shared data. To enable all participants to store, retrieve, verify, and evaluate the data in the blockchain, an interface is needed. This interface would be used by all participants to enter information and would therefore be the dApp.

2.9.4 Blockchain 4.0: Decentralized Artificial Intelligence

Blockchain 4.0 introduces decentralized artificial intelligence (DAI) which will produce autonomous decision-making. It comes into existence thanks to the collective use of blockchain and artificial intelligence (AI). While blockchain provides data accuracy, AI enables computers to learn from existing data. This is a rather unlikely combination of technologies, as blockchain is programmed to produce the same result while the input remains the same and AI is based on probabilistic theory. Differentiated from smart contracts, Blockchain 4.0 does not require any human interference. The blockchain can be loosely or tightly managed regarding which areas to operate, but the focus is on direction rather than what to execute. Hence, the main value driver in it is that it can make judgments and execute functions without any management supervision. (Angelis et al., 2018)

Blockchain 4.0 can be viewed as an extension of industry 4.0 which is the transition from centrally controlled production to decentralized aiming to increase both efficiency and product quality (Dukanović, 2018). The goal of industry 4.0 is to produce a self-organizing production line as well as a self-organizing value chain. Dukanović (2018) further states that blockchain can play an important part in actualizing industry 4.0; it is necessary for products to be self-aware, that any necessary data is available upon demand, as well as that data platforms are able to store, exchange, and trade data across the entire value chain. In order to achieve this, an inter-organizational collaboration as well as flexibility to re-organize the value chain is imperative. Another important factor is IT security; factories in industry 4.0 will be more sensitive of being exploited through security vulnerabilities. Regular protocol data consist of data regarding collaborations, logistics, and other confidential production information, and the risk of it being accessed by unauthorized users is hence substantial. Blockchain comes into play here as it establishes a mutual trust between the different actors, can verify identities, and provides knowledge and intellectual property protection.

2.10 Blockchain and Sustainability

In all aspects of new technology there is a need for maintaining its performance and therefore sustainability. It needs to be ensured that the technology can sustain for generations to come. Sustainability can be broken down into three parts: economic sustainability, social sustainability, and environmental sustainability (Azapagic et al., 2014).
technology has been predicted to be a promising catalyst for achieving global sustainable development targets. For instance, building a smart city through the development of shared economic services can be achieved with the use of blockchain. The trust and integrity that blockchain brings may enhance the social sustainability in many geographical areas and eliminate the need for corrupted central authorities. However, while there are great possibilities for blockchain from a social sustainability perspective, there are still issues that have to be solved. Especially bitcoin has been criticized for the high energy consumption, as blockchain technology requires miners to use a substantial amount of computer power. Bitcoin has also received criticism for being used for illegal activities (Giungato, et al., 2017).

Figure 7: The three components of sustainability
3 Theoretical Framework - Implementation

This section aims to give the reader a better understanding of the implementation framework of different technologies and systems, including blockchain. The section covers theory on technology diffusion, which is important to have an understanding for when implementing a new technology, such as blockchain. Contingency theory concerns contextual factors that make each implementation unique and is presented as a means to deepen the analysis. As this thesis is concerned with investigating how to successfully implement blockchain technology, it is naturally also interesting to investigate reasons as to why an implementation would fail. Therefore, theory on dispositional resistance to change is covered in this section. The concept of critical success factors (CSFs) is used to investigate what has to be done in order to successfully implement blockchain technology. Theory on value creation and value capture are covered as a way to provide background for the second sub-question. Theory on commonly implemented processes: agile methodology, lean philosophy, and Enterprise Resource Planning (ERP), and their CSFs are investigated as a way of investigating if these are also important for blockchain technology.

3.1 Implementation of Innovative Technology

According to Fixsen et al. (2005), implementation is defined as "a specified set of activities designed to put into practice an activity or program of known dimensions". Introducing technological change in an organization often presents challenges for management (Mabey et al., 1993). Adopting a new technology in an organization requires active engagement of the adopter, more than just selecting which technology to adopt. The current business process is often streamlined and re-engineered to take advantage of the technology (Comin et al., 2007). In this thesis, the building of the system is separated from the implementation process, meaning that the aim is not to build a blockchain but to put it into use.

According to Petersilia (1990), a community needs to recognize and accept the premise that a change in corrections is needed, is affordable, and does not conflict with its sentiments regarding just punishment. If not, an innovative project has little hope of surviving, much less succeeding. Stress following an implementation in an organization decreases if there is a greater inclusion of employees in the planning process. For companies that rely heavily on human interaction, there is a great need for communication and a clear theory of change (Fixsen et al., 2005). Other factors for successful implementation of information technology, identified by Cooper et. al. (1990), are: top management support of the implementation effort, good IT design, appropriate user-designer interaction, commitment to change, extensive project definition and planning, and recognizing and managing the diversity of stakeholders.

3.2 Blockchain Implementation

When implementing a new technology, the first step is to understand what it is, its potential use, what is hoped to be achieved by implementing the technology, and then how to implement it with a low risk of disrupting the organization. For blockchain, this means that it needs to be determined if blockchain is a good fit for solving an existing issue, it needs to be investigated if the organization is ready for change, and it needs to be analyzed how to incorporate and use training to support the implementation (Mundra, 2018). Du, et. al. (2018) has conducted a case study of a blockchain implementation in an
organization that has successfully implemented it. They take the view that an effective implementation of blockchain can be seen as a process in which its affordances are actualized. This means that the identified potential use of blockchain technology is realized in the organization and brings the expected results. Their main findings were firstly that there is a need for a supportive environment and that there should be a development towards wanting to work with startups in blockchain implementation because startups have more advanced technical and innovative capabilities. Secondly, that the corporate strategy of digitalization was important as a technology’s alignment with the corporate strategy is an important success factor in technology implementation. Thirdly, their findings showed that a culture that supports internal entrepreneurship played an important role in avoiding the feeling of that the new implementation was a deviation from the core functions and therefore discouraged.

Drescher (2017) has developed a framework for analyzing blockchain applications. According to this framework, it needs to be decided whether a certain blockchain application is useful and whether or not it creates a tangible value. In this framework, there are a few topics that need to be addressed to properly analyze the use of blockchain. It needs to be made clear what kind of blockchain is used, i.e. if it is public or private as well as if it is permissioned or permissionless. After this, it needs to be investigated what value is added from using the blockchain, i.e. decide what the advantages of implementing it are and assess if these advantages outweigh the disadvantages. This will make it evident if the blockchain is used because it creates a value or if it is used only for the sake of using it. Then, the business case needs to be analyzed. This includes determining what the costs are and whether the value brought by implementing blockchain technology covers this.

There is of course also the technical aspect of implementing blockchain technology. As blockchain is still quite a new technology, there are some technical issues that could stand in the way of a successful implementation. These include: throughput issues (meaning how many transactions per second it can handle), latency issues, size and bandwidth issues, scalability issues, and security issues. (Karafiloski, et al., 2017)

3.3 Technology Diffusion

According to Hall et. al. (2003), diffusion is a result of a series of individual decisions to begin using the new technology, for instance blockchain. Viewed from a technological diffusion perspective, IT implementation is defined as "an organizational effort directed toward diffusing appropriate information technology within a user community" (Cooper et al., 1990). Unlike the invention of a new technology, the diffusion of it usually appears as a continuous and rather slow process (Hall et al., 2003). Rogers (2003) has developed a model for how innovation diffuses, called the technology adoption lifecycle. The model divides adopters into five categories depending on when they adopt the technology and these are: innovators, early adopters, early majority, late majority, and laggards. Innovators consist of 2.5 % of the market population and consists of organizations or individuals who are willing to take high risks, have a strong financial position, are educated, and are seen as visionaries and enthusiasts. Early adopters consists of 13.5 % of the market population and are usually some type of educated opinion or community leaders who wants to get ahead of their competitors and are usually considered pragmatists. The early majority makes up 34 % of the market population and are typically slightly more conservative, however still open and proactive towards new idea. The late majority also constitutes 34 % of the market population and they are even more conservative and less engaged in the community and
are fairly reluctant towards new ideas. The last group are the laggards, which constitute 16% of the market population and are very conservative. They only want to adopt the new technology when they feel pressured to do so. The accumulated market share is typically represented by the S-curve, which is illustrated in figure 8.

Figure 8: Technology Adoption Lifecycle and the S-curve

However, Hall et. al. (2003) open up for the idea that adapting new technology is similar to any other kind of investment under uncertainty and can therefore be analyzed in the same way. The adoption of new technology would then be characterized by: uncertainty over future profit streams, irreversibility that creates at least some sunk cost, and the opportunity to delay. This theory means that an organization will choose to invest when the potential profit will exceed the cost. However, Hall et. al. (2003) also point out some other factors that affect the decision to adopt new technology. The first factor is the skill level of workers and the state of capital of goods, because both workers and capital goods are crucial for successful implementation and operation of a new invention. If there is a need for complex new skills, and if it is time-consuming to acquire these new skills, then the adoption may be slow. The second factor is the customer commitment and relationships; in certain industries, organizations want to make sure that there will be future income that can pay for the investment. The last factor is network effects; a technology is said to have network effects when the value of it increases with the number of users in the network. Network effects significantly impact technology adoption since they affect the expected benefit from a new technology. The diffusion of general purpose technologies are particularly subject to network effects. Another factor is that a new technology may be imperfect in its early stages and therefore makes the diffusion of it more difficult. The size of the organization also plays a role in the diffusion. Organizations that are larger tend to undertake innovation more often than smaller organization, as they typically have more funding. However, larger organizations often have multiple levels of bureaucracy and this can slow down the decision making. Another factor that affects the diffusion rate is the government and regulation, as these may create laws that hinder organizations from full implementation.
3.4 Contingency theory

It is important to remember that implementation occurs in the context of a community, for instance an organization, a city or a business. It is of great importance to have an understanding for the current needs and strengths of a community prior to selecting and attempting to implement an innovation (Fixsen et al., 2005). Moving away from traditional management approaches - that there is only one best way to manage an organization - contingency theory argues that which this best structure is, is contingent on the organizational environment and structure (Galbraith, 1974). Such environmental factors include uncertainty, complexity, and competition. The structural factors that can affect the implementation include authority, control, and power that is gained through different control mechanisms such as formalization, centralization, and differentiation of work. Roering, et al. (1985) state that organizations with organic structures, meaning that there is a low level of formalization and centralization, are more effective in regards to innovation, flexibility, and adaptiveness. Galbraith (1974) argues that a high level of uncertainty while starting a project will cause a need for a high level of information processing between the decision makers during the actual project execution. Contingency theory says that control should be structured in the best way suitable to support strategy implementation (Ghofar et al., 2015). This is done by fitting the characteristics of an organization to the contingencies that affect said organization (Donaldson, 2001). For implementing blockchain, this means that the organizational environment and structure will affect what actions are necessary.

3.5 Dispositional Resistance to Change

Dispositional resistance to change can be defined as the tendency of an individual to avoid and defy making changes across different contexts and different types of change (Oreg, 2003). The construct has been proven to be distinct from certain personality traits like openness to experience, sensation seeking, and tolerance for ambiguity. The construct of dispositional resistance to change has instead proven to predict how individuals will be affected and how they will respond to different change scenarios. Dispositional resistance to change is made up of four dimensions, together capturing the cognitive, affective, and behavioural biases. The cognitive perspective regards rigidity and an unwillingness to agree to and accept new ideas. The affective side considers the emotional reaction to change as well as short-term focus; how uncomfortable and stressed does an individual become when faced with change and to which degree does an individual focus on the short-term challenges versus the long-term benefits of the change? The behavioural aspect concerns to which extent an individual tends to seek a stable environment. Within organizations, the concept of dispositional resistance to change can be used to explain collectives’ adaptiveness and openness to change. (Oreg et al., 2018).

Innovation is of great importance for an organization’s competitive advantage. However, innovation often forces change and adjustment within the organization and results in costs both monetary and for the employees, for instance; loss of power and prestige, need to train and relearn, changing definition of success, and fear of technology. To avoid these costs, employees may try to fight the change rather than adapt to it. Organizations with higher resistance to change therefore tend to not adopt new technology as much. Incremental innovation meets much less resistance than radical innovation as a radical innovation requires more changes to be made (Fosfuri et al., 2009). Resistance to change is handled using change management; for instance, it is of importance to train and educate employees and to involve change agents that lead the change implementation (Lines, et al., 2015).
Also, it is of importance to involve employees in the learning, planning, and implementation stages of a change process (Coch et al., 1948). Another important factor to consider is communication; communication is crucial in planning, implementing and managing change as resistance to change is heavily influenced by bad communication (DiFonzo, 1998). It is also of importance that the employees understand why change is necessary and that they are aware of the problem (Fritzenschaft, 2014).

3.6 Critical Success Factors

According to Hassan (2007) the term critical success factor (CSF) first appeared in the literature in the 1980s as a concept used to investigate why some organizations seemed to be more successful than others. Hassan (2007) further defines the concept as "those things that must me done if an organization is to be successful". CSFs should be few in numbers, measurable, and controllable. Corkindale, et al. (2013) defines CSFs as factors that, if satisfactory, will guarantee successful performance of the organization - including improvements in dimensions such as financial, operational, and customer service. A similar definition to the two previous is given by Bullen et al. (1981) who state that s are the few areas where satisfactory results will enable successful competitive performance for the organization.

CSFs are often used to analyze change projects where the CSFs enhance the likelihood of successful change by minimizing resistance to the project. In terms of change management, the aim is to find a list of variables, conditions, and characteristics that are expected to have a serious direct or indirect impact on the outcomes of an organizational transformation. (Fritzenschaft, 2014).

3.7 Value Creation and Value Capture

The very nature of blockchain technology requires the use of a network and working together with other organizations. According to Dyer, et al. (2018), organizations that work by engaging in repeating alliances are expected to gather greater benefits than those who do not due to the increased trust and level of coordination in relationships. Oppositely, repeated alliances can also show a negative correlation to value creation because it causes an increase in competition between the alliance partners for value capturing. Factors that lead to value creation can be summarized as: complementary resources with either high or low interdependence, relation-specific assets, knowledge-sharing routines, and effective governance. The reasoning behind these factors is that investments increase with higher interdependence and further evolve with knowledge sharing and relation-specific assets. Value creation typically follows the S-curve, as illustrated in figure 8, meaning that it will decline at some point. Value capturing is also achieved by a number of factors: being superior at replicating or absorbing the partner’s complementary resources, developing additional VRIO resources (Value, Rarity, Imitability, Organization), partaking in assymetric investments in relation-specific assets, and one partner’s alliance-specific resources being imitated by a competitor in such a way that their bargaining power is decreased.

Dyer, et al. (2018) also list factors that contribute to diminished value creation: decrease in resource complementarity, increase in relational inactivity meaning that trust increases, market competition in alliance value creation resources, and environmental dynamism resulting in no alliance value creation resources.
According to Ozkan et al. (2018), interactions are the main factor for value creation as co-creation and they further state that individuals themselves construct their own contextualized outcome of value through their different interactions with the entities in a network, meaning that value is created through social or individual usage of resources and processes. The actual value creation process is in fact separated from the market and is simply the different parties exchanging value.

3.8 Commonly implemented processes and their CSFs

In the following section, three commonly implemented processes or methodologies are described. The theory on these processes and their CSFs are used for identifying factors that are potentially important for implementing blockchain. These processes’ basic functions and characteristics are also described as a way to understand how the CSFs connect to their process and to enable comparison between them and blockchain technology.

3.8.1 Agile Methodology

There are several types of agile methodology, but their common ground is that they attempt to define a set of disciplines: project management, project-life cycle, team management, engineering, and delivery (Berzisa et al., 2016). Berzisa et al. (2016) further state that a well-defined PM is needed to ensure that a project does not fail due to a low project maturity level. The success factors of implementing agile methodology project management are closely linked to people factors: customers, team (both motivation and size), company culture, as well as planning and scheduling. In figure 9, the method for adaption and implementation of the agile project management technology is visualized.

Figure 9: Visual representation of the method for adaption and implementation of the agile project management technology.

The 'agile manifesto', presented by Fowler et al. (2001) states the key aspects of working with an agile methodology: individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contact negotiation, and responding to change over following a plan. Fowler et al. (2001) further present
that agile processes promote sustainable development, in the sense of finding a working pace for the workers which can be sustained over the entirety of the project. The agile methodology is furthermore defined by simplicity; it is easier to add something on later to a process that is too simple than it is to remove something from a process that proves to be too complicated.

Working with agile methodology means to focus on small deliverables, helping the project speed to be maximized during its entire length instead of just close to the project due date. Constant pressure is thus put on the project, which helps the stakeholders and owners of the project as they are able to see the progress over time (Laskowski, 2011). These small deliverables are known as 'sprints' and with each iteration, a feature is added to the product resulting in a project growth. By validating the product features early on, the risk of producing a failed product is much lower. The agile development process is illustrated in figure 10.

![Figure 10: Illustration of the agile development process.](image)

Dikert, et al. (2016) list 29 success factors in agile transformation, including good management support, commitment to change, providing good leadership, customization of the agile approach to the organization’s needs, piloting the agile way of working to gather insights, providing training and coaching, find a way to engage each employee in the organization, keeping the change communicable and transparent, and concentrating on aligning the organization while still allowing teams to self-organize.

### 3.8.2 Lean Philosophy

Lean is a set of techniques connected to the untiring strive to eliminate waste and to maximize value for the customer. Anything that does not add value from the customer’s perspective is considered a waste and should therefore be eliminated (Alsterman, et al., 2014). Lean has its origin in the Toyota production system and is therefore originally and typically concerned with manufacturing (Wilson, 2010). However, the lean philosophy has quickly spread to many other lines of business, for instance service, trade, and the public sector (Leite et al., 2015).

Implementing lean is difficult in many ways and there are many reasons as to why an implementation of lean could fail. One reason is that the introduction of lean may end up disrupting the very process it is meant to improve. The reason for this is often that employees, driven by fear of losing their job, are prepared to sabotage the change. Other reasons may be lack of proper planning, lack of management involvement and commitment.
or lack of a clear vision and strategy (Achanga, et al., 2006). According to Bhasin et al. (2006), a reason that a lot of lean implementations fail is that companies consider lean as a process rather than a philosophy. Lean should be adopted as a way of thinking rather than as tactics or processes. They further state that the biggest issues that companies encounter are a lack of direction, a lack of planning, and a lack of adequate project sequencing. Knowledge of particular tools and techniques commonly used in lean is often not the issue. Wilson (2010) emphasizes the need for sufficient training; it is of importance to have trained problem solvers that are aware of their roles in the implementation. He also identifies the need for a well established motivation in the organization. This is achieved through spreading the knowledge about lean throughout the organization and by making sure that leaders show their motivation through action. Dave (2013) also identifies lack of resources (i.e. employees, material, and machine with advanced technology) as a possible hinder for implementing lean.

Netland (2016) has analyzed existing literature in order to identify CSFs for implementing lean. These include (in order of descending importance: management commitment and involvement, training and education, employee participation and empowerment, alignment to strategy and long-term plan, managing cultural change, supplier involvement, customer involvement, teamwork, process management, structured approach and project prioritizing, benchmarking and knowledge transfer, cross-functional integration, quality data analysis, project management skills, performance measurement, organization infrastructure, sustain continuous improvement, quality control and robust processes, use of tools, techniques and technologies, communication, rewards and recognition, job security, and social responsibility. However, Netland (2016) also makes the point that a successful implementation of lean cannot be reduced merely to success factors. Whether the implementation is successful or not depends greatly on contingencies and circumstances.

3.8.3 Enterprise Resource Planning

Enterprise resource planning (ERP) is a way of attempting to predict how much of a resource will be allocated on a task, and is thus a way of trying to balance different projects’ workload. The problem with ERP is that projects seldom execute as planned. The solution to this is to plan by each project resource skill set rather than by individuals’ skill sets, to learn how to capture when a project is heading into the ‘red zone’, focus on one or two skill sets that are affecting the project duration the most, and lastly that some of the resources most needed to keep the project duration to its minimum might not even be modeled in the project plan (top management, customers, and support groups for example). (Austin et al., 2013)

Sharma (2004) states that ERP does not focus on either resources or planning, but rather on the part that is enterprise. ERP attempts to integrate all the different functions and departments in an organizations into a computer system that can both serve and fulfill all those departments’ needs. These individual departments would otherwise have their own computer system, working optimized towards their specific way of working, and integrating these will make it possible for the departments to communicate more effectively which can of course stimulate a huge payback for the organization. For an integrated system to be defined as a ERP, it requires a few key characteristics: it should be flexible enough to respond to the changing needs of an enterprise, comprehensive enough to support a variety of businesses, not be confined to the organizational boundaries, have a collection of best business processes, simulate the reality of business processes on the computers, and it has
to have an open system architecture. An open system architecture means that any module can be both interfaced or detached whenever it is required without affecting other modules. The structure of ERP is visualized in figure 11.

Figure 11: Visual representation of an ERP structure.

ERP is costly to implement and is a long and on-going process. Most organizations report that an implementation process stretches over 12-18 months and that it takes an additional 1-3 years to see any actual transitional change in the organization. The actual change thus happens over time as everyone in the organization learns the new system, which is necessary since ERP requires a corporate wide change for the ERP solution to happen. (Sharma, 2004).

ERP project success can be divided into two stages: an immediate implementation success construct and an organizational performance construct (Corkindale, et al., 2013). Abdul­lah, et al. (2018) lists the CSFs for ERP as: organizational culture and readiness for culture change, good project management, integration of business processes, user training and education, teamwork and project team composition, system quality, system integration, and committed top management.
4 Context: Blockchain in Trade Finance

The following section aims to give the reader an understanding for the context that has been chosen for this thesis; the trade finance industry. This section starts off with a general view on blockchain implementation efforts in different industries to show that the finance industry is the furthest along when it comes to implementing the blockchain technology. Then, the trade finance industry is described more specifically as a way to understand its characteristics and how these may affect an implementation process of blockchain. After this, different blockchain platforms and blockchain consortia within trade finance are described as these are the current blockchain efforts in trade finance, and the interviewed banks that are currently partaking in a blockchain project are taking part in these. To finish this section, as a way of describing a blockchain implementation project’s characteristics, the terms use case and proof of Concept are explored.

4.1 Blockchain implementation efforts

Blockchain technology has the potential to disrupt economic and financial sectors (Manski, 2017). According to Gomber, et al. (2017), the financial industry is also seen as the primary user of blockchain. This is partly due to bitcoin being the most famous use case of blockchain technology, but it is also due to the fact that the finance industry has substantial process inefficiencies and a large cost base issue. It is not always possible to identify the correct present owner of an asset and it may be complicated to retrace ownership over a long chain of changing buyers in global financial transactions services. These issues could be solved by the use of blockchain. Gomber, et al. (2017) also list a few examples of blockchain applications within the finance sector: cryptocurrencies, securities issuance, trading, settlement, and insurances.

PwC consulting group (2018) has conducted a survey containing the answers of 600 executives from a total of 15 different territories. Out of these, 84% claim to have some kind of involvement with the blockchain technology and forecasts claim that between 20 and 30% of the global economic infrastructure will be blockchain based by 2030. PwC’s survey results further explains the different stages which the blockchain involved companies are currently, which is displayed in figure 12:

![Figure 12: Statistics of how far along companies are with implementing blockchain, adopted from PwC (2018).](image)

The survey further investigated which industries were seen as leaders in implementing blockchain, where the finance industry proved to be far ahead of all other industries. These results are illustrated in figure 13:

![Figure 13:](image)
As of today, the United States of America is seen as the blockchain leader around the world. However, it is predicted that China will be the most dominant in just a few years. The survey further concludes the most prominent factors in holding the blockchain adoption back as: regulatory uncertainty, lack of trust among users, inability to bring network together, separate blockchains not co-operating, inability to scale the blockchain, concerns with intellectual property, and concerns with audit and compliance. (PwC, 2018).

4.2 Trade Finance

Trade finance can be broadly divided into three parts: exporter finance (Open account), importer finance (Cash in Advance), and bank of finance (Letter of Credit). The Open account is the most important contract constituting for 43% of the total value of trade finance. An estimation is that 90% of all trade transactions are in some way trade finance and that the overall trade finance market constitutes of somewhere between $10-$12 trillion. These three different kinds of trade finance are for firms to choose between, considering the different trade-offs between them; what are the cultural scenarios and how do each of them affect trade regarding price and quantity. (Schmidt-Eisenlohr, 2013).

Trade often involves exporting lags of some kind; exporting lags means that there is a delay between the production of the goods and the consumption of them on a foreign market. This is because it takes a lot of time to not only produce and transport goods, but also to fulfill the shipping requirements such as customs, administrative, and port. The exporter can be paid either in advance or at the time of the goods reaching the importer’s location. Payments in advance are known as Cash in Advance transactions and can be explained as the importer lending money to the exporter. Payments occurring as the goods reach the importer are known as Open account and can be explained as the

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**Figure 13:** Statistics of which industries are seen as the most advanced in implementing blockchain, adopted from PwC (2018).
exporter lending the importer the exported goods before the importer sells the goods in
order to pay back the loan. In a transaction with a letter of credit, a bank will usually
pay for the goods on behalf of the importer before the goods are shipped - meaning that
the bank becomes a middle-hand between the exporter and importer. (Antrás et al., 2011).

The traditional trade finance process is visualized in figure 14. BPO stands for Bank
Payment Obligation, in which electronic data matching is used to make payments between
the importer and the exporter’s banks possible (Chandna, et al., 2017).

Chandna, et al. (2017) further state that trading companies and banks in general are slow
to adapt to new technologies due to the fact that the industry has looked and worked the
same for many years, but that the blockchain technology has the potential to completely
disrupt the finance industry. The issue with BPO is that only one party can partake in
the document-checking process, and with blockchain this may become a non-issue. The
actual potential of blockchain in the finance industry has yet to be proved but it seems
more promising than BPO.

Many banks like talking about digitalization within the trade finance industry, but the
number of actual participants in digitalization efforts is surprisingly low. Through the sur-
vey "Euromoney Trade Finance Survey 2018", with 7,000 plus participants, it was brought
to attention that only 6 % of the respondents have used the technology. Change in the
trade finance industry is slow-moving due to the fact that there are many parties involved
in a trade transaction and these parties all have different capabilities and different views
of the value in digitalization. The main problem of bringing in a new technology in the
industry is the very nature of the market; each transaction is unique. There is also a large
diversity over the globe; not all jurisdiction have come as far in validating electronic signa-
tures as of now and many still require paper documents to be submitted. For a blockchain

Figure 14: Visual representation of the traditional trade finance process, adopted from
implementation to be successful, not only banks but also shipping companies, governments, and insurers need to be willing to take the leap. (Long, 2017)

4.3 Use Case

In the trade finance industry, there are today a number of use cases (Deutsche Bank, 2017). A use case is a list of tasks that an actor can perform and is connected to the specific business processes of an organization or an industry. A use case is defined in order to clarify what the requirements of a task are. A regular list of requirements does not actually address the potential use of a solution, so a use case is used to further define what the different roles in a project will contribute with in the solution. Furthermore, the business process will define how the different roles will execute their work. (IBM, 2016).

4.4 Proof of Concept

A Proof of Concept (PoC) is used to visualize the feasibility and practicality in a potential project. For blockchain in trade finance, there exists numerous PoCs; these are all attempts and ideas that different banks have had for using blockchain, which have either had a positive result and thus have become ideas in production, or have had negative results and therefore have been shut down (Acheson, 2018). A PoC is a prototype, not necessarily provided with code, that is used within an organization to gain a better understanding for a particular potential project. These PoCs explore use cases in the context of their own customer expectations and business operations. A PoC consists of the evaluation of whether or not there exists a business process that relies heavily upon trust, if multiple parties should be able to alter the same data, if a business process has many manual steps, what the settings regarding data integrity are, and if there are any intermediaries that control the single source of truth. These questions spark the conversation on whether or not blockchain is a potential useful and value creating database for the organization to use. In a PoC, which blockchain platform to use is also considered based on what the goal of the implementation is. (Reichard, 2018).

4.5 Blockchain Platforms in Trade Finance

There is an increasing number of different blockchain platforms, which is the technology upon which a blockchain is built. However, in this thesis, only Corda and Hyperledger Fabric will be considered, as these are the platforms that the currently largest blockchain initiatives (see section 4.6) in trade finance are based upon.

4.5.1 IBM Hyperledger Fabric

Hyperledger Fabric intends to provide a modular and extendable architecture that can be employed in various industries, for instance banking, health care, and supply chain. It is permissioned and private and there is no need for a built-in cryptocurrency as consensus is not reached via mining. Hyperledger Fabric’s understanding of consensus is broad and includes the entire transaction flow, starting from proposing a transaction to the network to committing it to the ledger. In the process of reaching consensus, nodes assume different tasks and roles. The nodes can be either clients, peers or orderers. A client communicate with both peers and orderers, and acts on behalf of an end-user. It creates and invokes transactions. Peers maintain the ledger and receive ordered update messages from orderers for committing new transactions to the ledger. Endorsers are a special type of peer and their task is to endorse a transaction by checking whether they fulfill certain conditions.
Orderers provide a communication channel to clients and peers where messages containing transactions are sent. The channels make sure that all peers are delivered the same messages in the same logical order. The consensus algorithm used is "pluggable", which means that depending on application specific requirements, various algorithms can be used. The transaction flow starts with a client sending a transaction to the connected endorsers to initiate an update of the ledger. All endorsers then have to agree upon the transaction, which means that consensus has to be reached regarding the update. The client then collects all of the approvals from the endorsers and the approved transaction is sent to the connected orderers which again reaches consensus. The transaction is then forwarded to peers holding the ledger for committing the transaction. Fabric allows for control over consensus and restricted access to transactions. This results in an improved performance scalability and privacy. Compared to Corda, Hyperledger Fabric is more flexible, due to its modular design. It can be tailored to resemble the features of Corda, but it can also suit other industries than the finance industry. (Valenta et. al., 2017)

4.5.2 R3 Corda

R3 Corda is a specialized distributed ledger platform for the finance industry, and takes the highly regulatory environment into account. It is permissioned and private and the platform does not use any currency, as consensus is not reached via mining. Much like for Hyperledger Fabric, Corda reaches consensus at transaction level by involving parties only. Consensus is reached based on transaction validity and transaction uniqueness. Validity is ensured by running the smart contract code that is associated with a transaction. It checks all the required signatures and makes sure that any transactions that are referred to are also valid. Uniqueness concerns the input state of a transaction. It has to be made sure that there does not exist any other transactions that consumes any of the same state, to avoid double-spending. As is the case in Hyperledger Fabric, the consensus algorithm is "pluggable". Consensus over uniqueness is reached among participants called notary nodes. As Corda is focused only on the finance industry, the architectural design is simpler and may therefore offer a more "out-of-the-box" experience. (Valenta et. al., 2017)

4.6 Blockchain Consortia

Within trade finance, there are foremost five different blockchain consortia that remain relevant to mention: Marco Polo, We.trade, Voltron, Batavia, and HKTFP. These will be described in the following section as to understand which initiatives are currently active in the trade finance industry. The banks interviewed in this thesis that are currently working with blockchain are part of some blockchain consortia and therefore it is important to understand them. The different blockchain consortia are visualized in figure 15.
4.6.1 Marco Polo

Marco Polo is the largest blockchain consortium and includes members from Europe, America, Asia, and the Middle East. It is open to any size of banks and has the largest number of bank members. Amongst the 170 banks in the network are: DNB, Bangkok Bank, SMCB, ING, Commerzbank, BNP Paribas, OP, Natixis, Standard Chartered, and NatWest. The focus of the consortium is to provide seamless data integration and to thus provide better customer experience by reducing costs, risk, and time. Other members of the system apart from banks are credit insurers, logistics companies, and B2B networks to name a few. The system is built on a system created through a collaboration between R3’s Corda and TradeIX. (Marco Polo, 2019).

4.6.2 we.Trade

We.Trade stems from a collaboration between Nordea and several other large banking institutions, including: Santander, UniCredit, Societe General, UBS, Rabobank, Natixis, KBC, HSBC, Erste Group, Eurobank, and CaixaBank. The consortium is built on the IBM blockchain platform using Hyperledger Fabric. By leveraging an innovative way of working with smart contracts, the consortium aims to bring up new opportunities for the trading industry. (We.trade, 2019).

4.6.3 Voltron

Voltron is a new blockchain consortium which aims to start operating in 2019. The consortium is built on a collaboration between R3’s Corda and CryptoBLK and will make it possible for banks to speed up transactions and thus enhance customer experience. Especially it will provide letter credit transaction for the different financial institutions that are members. Participating banks include SEB, Bangkok Bank, NatWest, BBVA, BNP Paribas, Mizuho, ING, Intesa SanPaolo, HSBC, Scotiabank, and US bancorp. (Morris, 2018).

4.6.4 Batavia

Built on IBM’s Hyperledger Fabric, Batavia aimed to simplify the end-to-end process of a trade by digitalizing and automating international trade transactions (Keller, 2018). The members of Batavia consisted of: CaixaBank, UBS, Erste, BMO, and Commerzbank. After
CaixaBank, Erste Group, and UBS decided to leave the Batavia consortium and become shareholders of We.trade, Batavia ceased to exist. (Morris, 2018).

4.6.5 HKTFP

HKTFP, Hong Kong Trade Finance Platform, is a new blockchain consortium within the trade finance industry and has its base in Hong Kong. The objective of the HKTFP consortium is to digitalize trade documents including letters of credit, invoices, purchase orders, and shipment tracking data (KPMG, 2018). The technology is provided by the Ping An Group.
5 Method

This section describes the methodology used in this thesis. The research approach, research process, problem definition, literature review, feasibility study, and the collection of data for the main study will be described in this section. All interviewees are presented and the section also covers the methodology for the data analysis, discussion of collected data, conclusion, and research quality.

5.1 Research Approach

This thesis has a method that is mainly qualitative in its nature. According to Neuman (2014), qualitative methods are best understood as data enhancers that enables researches to see key aspects more clearly. In contrast to a quantitative method, a qualitative method gathers non-numerical information. The data is rather captured in the form of words, images, or objects. Based on the research question, this approach was seen to be the best fit.

This thesis aims to fill a gap in the existing literature on blockchain. Gap spotting is the most common way to generate research questions. It is done through identifying gaps in existing literature and then formulating a research question that aims to fill that gap (Alvesson et al., 2011a). According to Alvesson et al. (2011b) gap-spotting rarely involves a simple identification of obvious gaps. It is rather a complex, constructive, and sometimes creative process. This has been true for this thesis, and finding the research question has been an iterative process consisting of an extensive literature review and interviews with experts in the field.

5.2 Research Process

The research process is thoroughly described in the following section as to give the reader a good sense of which steps were needed to be followed in order to find an answer to the research questions. The overall research process is illustrated in figure 16.

![Figure 16: Visual representation of the research process.](image_url)
5.2.1 Problem Definition

Upon defining the overall theme of this thesis along with KPMG and KTH, "Blockchain", the next step was to define in what sense the subject should be explored. The scope was to pertain to KPMG’s current business interests while also be of benefit to the scientific community. The task of defining the problem was an iterative process, containing a literature review and a feasibility study to find a gap in the existing literature and previously done work. Throughout the length of the study, continuous meetings were held with both the supervisors at KPMG and KTH in order to ensure that the development of the project and the found results remained both relevant and valuable. A meeting between KTH and KPMG was held to ensure that the parts agreed on the feasibility of this thesis.

5.2.2 Literature Review

According to Turner (2018) the literature review provides the foundation for the study and is of importance for a substantial, thorough, and sophisticated research. Also, a literature review should be more than a summary of existing literature; it should be an analysis of it. With this in mind, the literature review was conducted as described below.

To start out, the focus of literature review was quite broad and focused on the technical aspect of blockchain as to create an understanding of what has been written about blockchain recently and to understand how the technology works. It was found that there is no consensus on the definition of what blockchain is and includes, everyone seems to have their own definition of it (Furlonger, 2017). For the purpose of this thesis, the choice was made not to limit blockchain to a single definition. This was decided to not be necessary, it is more important that the interviewee has their own definition and claims to work with implementing blockchain technology. As the research question, aim, and purpose evolved and was defined, more specific search terms were used. The literature was collected by the use of online search engines.

Articles used have come from a wide range of journals and books and by recommendation of journals and books from other researchers within the field. According to Collis et al. (2009), qualitative data needs to be understood within its context. They further state that understanding the context will later, in the analysis, create richness and depth in the findings. Therefore, the authors of this thesis aimed to gather theoretical knowledge about the finance industry through literature. As blockchain is such a new technology, and changes are happening fast, the authors have aimed to only use sources from 2017 or later on the subject as to avoid using outdated information. However, theory on general implementation was decided upon to not be as fast-changing and there was hence no limit set on the sources on that area.

The purpose of reviewing literature on implementation of lean, enterprise resource planning and agile methodology was to find inspiration in which CSFs could be identified for the implementation of these. These were then investigated as to see if they could also be identified as CSFs for the implementation of blockchain technology.

The literature review has been of an exhaustive character. However, due to time limitations there may of course exist relevant literature that was not taken into consideration in this thesis.
5.2.3 Feasibility Study

The purpose of conducting a feasibility study is to answer the question: "Can this study be done?". In contrast to a pilot study, where a version of the main study is run in miniature, the feasibility study aims at finding and estimating parameters that are needed to design the main study (Tickle-Degnen, 2013). For the case of this thesis, the feasibility study was used to decide which industry to direct the research questions towards as a means of narrowing down the scope. Through unstructured interviews with key people at KPMG, it was decided that it would be best to focus on an industry where blockchain technology is already being implemented.

Semi-structured interviews were held with experts on the field of blockchain and researchers focusing their work on blockchain. One advantage of using semi-structured interviews is that depending on what answers are found, one subject may be explored deeper. This allows for findings that may not have been expected beforehand. Another advantage of using semi-structured interviews is that the method generates reliable and comparable qualitative data (Given, 2008). It opens up for identifying new ways of seeing and understanding the implementation of blockchain technology.

A questionnaire designed specifically for the purpose of the feasibility study was used for the interviews, see appendix A. The questions were formulated with everyday language as to reduce possible misunderstandings from the respondents, and so that the questions would be interpreted in the same way by each respondent. As replication logic is of importance, the same semi-structured questions were used for all interviews (Eisenhardt et al., 2007). However, at times, supplementary questions were asked and at times questions were skipped if the interviewee had already answered it in a previous question. The set of questions start with a focus on the respondent’s background and interest on the subject and then move on to their expertise in the area by focusing on more detailed questions.

All of the interviewees were contacted via e-mail. The experts were found primarily through websites for blockchain conferences or events and contacted based on their experience in the field. All of the interviews were held in Swedish, and the answers have been translated into English for the purpose of this thesis. Some of the interviews were held in person, at the office of the interviewee in Stockholm. However, most of the interviews were held via phone. All of the interviews were recorded. After the interviews, coding was performed on the recordings in order to identify and organize themes in the qualitative data. This was done to get a good overview and to make it easier to recognize similarities, differences, and patterns between the different interviewees. The listening of the recordings was done by both of the authors of this thesis separately, as to ensure objective results. Coding is an iterative process that will help analyze and make the most of the data (Cope, 2010). This was done through thematic analysis. There are six phases in a thematic analysis as described below.
**Phase 1:** Get familiarized with the data by repeated reading in an active way to search for meanings and patterns.

**Phase 2:** Generating Initial Codes. This was done using in vivo codes, i.e. descriptive codes that come directly from the statements or subjects.

**Phase 3:** Searching for themes among the Initial Codes.

**Phase 4:** Reviewing themes for meaningfulness, resonance, consensus, and validation.

**Phase 5:** Defining and naming each individual theme. An analysis that identifies what story each theme tells should be made.

**Phase 6:** Producing the report by writing a concise and non-repetitive account of the data across the themes. (Okwir, 2018)

Combined with the knowledge and insights gained from the literature study, these interviews resulted in a defined scope and constructed limitations for the thesis. The findings were that the finance industry is clearly the furthest along when it comes to using and implementing blockchain technology. As this thesis is focused on the implementation, the decision was taken that the thesis should focus on this industry. More specifically, it was decided to use trade finance as a context to further delimit the study. The results were also taken into consideration, together with the theoretical framework, when constructing the questionnaires for the main study.

### 5.2.4 The Collection of Data

In depth interviews were held with blockchain experts and financial companies, mainly banks, in the Nordic countries, that are interested in or have experience in implementing blockchain technology. The interviews were of semi-structured character and open-ended questions were used. The semi-structured approach is chosen to allow for findings that may not have been expected beforehand and to generate reliable and comparable qualitative data (Given, 2008). According to Collis et al. (2009), an issue with this type of research is finding suitable people that are willing to do an interview. However, this was never an issue in this thesis, probably because there is a bit of a hype surrounding the topic today.

As qualitative data is understood within its context, it is of importance to ask questions that will describe and provide an understanding for the context. Contextualization will enhance the sensitivity to the qualitative research data collected and aid in the interpretation and analysis (Collis et al. 2009). Therefore, all interviews started with questions about the interviewees’ experience and background. Then, based on the findings in the literature review and the feasibility study, questions on the topic were constructed. To ensure that the questions were perceived in the way they were intended to, the questions were tested on an unbiased audience prior to using them.

Similar to the feasibility study, the questions were constructed using everyday language as to reduce misunderstandings. The concept of a successful implementation was further defined as whether or not the blockchain technology brings value to the company. As in the feasibility study, the same semi-structured questions were used for all interviews to ensure replication logic (Eisenhardt et al., 2007). As it was known beforehand that the interviewees in the expert group did not have particular knowledge on blockchain in the context of trade finance, it was decided to construct different questionnaires for the experts and the banks; these can be found in appendices F and D. The questionnaire for the experts was hence constructed using more general questions on blockchain implementation whereas the questionnaire for the banks was designed to focus more on the characteristics of the
trade finance industry. As is the nature of semi-structured interviews, at times questions were skipped because the interviewee had already answered it in a previous question, and sometimes follow-up questions were asked to clarify or exemplify what the interviewee said.

As a complement to the semi-structured interview questions, a questionnaire was designed to get the interviewees’ opinion on the critical success factors that the authors of this thesis identified in the literature review. The questionnaires can be found in [1] and [4]. The choice was made to use a five degree scale, so that the interviewee could choose number 3; neutral, if they so wished, meaning that the interviewees were not forced to have an opinion. The intent of using rating questions was not to generate quantitative data. As the questionnaires have been answered only by the 12 interviewees used in this thesis, there is not enough data to draw any statistical conclusions. The aim was rather to encourage a discussion surrounding the different factors, and to access a deeper analysis through their comments and thoughts on them.

All of the interviewees were contacted via e-mail. The experts were found primarily through websites for blockchain conferences or events and contacted based on their experience in the field. Some experts were found through contacts. Some of the experts were used both in the feasibility study and the main study. The companies were contacted because they are large banks in the Nordics or in some other way large actors within the finance industry, and are currently working with or have in the past worked with blockchain technology. All of the interviews were held in Swedish except for three. The answers from the interviews that were held in Swedish have been translated into English for the purpose of this thesis.

Some of the interviews were held in person, at the office of the interviewee in Stockholm, and some were held via telephone. According to Collis et al. (2009), face-to-face interviews are more time-consuming and costly than phone or Skype interviews. However, the same personal contact cannot be established using phone or Skype, and therefore less nuanced answers may be given. Another advantage of using face-to-face interviews is that the interviewee may find it easier to disclose more sensitive information. In this thesis, phone interviews were chosen when the interviewee wished so, or when the interviewee was not based in Stockholm, due to time and cost limitations. All interviewees and the method of contact, as well as the date for the interview, can be seen in table 3. All interviews were held with only the authors of this thesis and one interviewee, except for the interview held with Enigio, where there were two interviewees.

All of the interviews were recorded, after permission was given, using mobile phones in order to be able to re-listen to them and to make sure that no information was lost. Also, all interviewees were asked if they wanted to be anonymous. Only two wished so and this can also be seen in table 3. The reason for keeping the names of the interviewees in the thesis is that they are key people in the very front of the development of blockchain technology. They have an in depth knowledge and understanding for the subject and the results are opinions rather than proven facts. Unlike in the feasibility study, the decision was made not to use coding. Instead, the gathered data was summarized in section 6 Results. This was seen to be the option for not loosing any valuable information. Also, the choice was made to separate the results from the analysis, to describe the interviews to its fullness.
Table 3 shows information on the interviews that were conducted during the study. Interviewees that wished to be anonymous are referred to as the number of order in which the interviews were conducted.

**Table 3:** Details of conducted interviews during the study.

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Group</th>
<th>Company</th>
<th>Date</th>
<th>Study</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rufus Lidman</td>
<td>Expert</td>
<td>AIAR</td>
<td>26-2-2019</td>
<td>Feasibility</td>
<td>Telephone</td>
</tr>
<tr>
<td>Eric Wall</td>
<td>Expert</td>
<td>Cinnober</td>
<td>26-2-2019</td>
<td>Feasibility</td>
<td>Personal</td>
</tr>
<tr>
<td>Nils von Heijne</td>
<td>Expert</td>
<td>Superblocks</td>
<td>5-3-2019</td>
<td>Feasibility</td>
<td>Telephone</td>
</tr>
<tr>
<td>Peter Altmann</td>
<td>Expert</td>
<td>RISE</td>
<td>7-3-2019</td>
<td>Main</td>
<td>Personal</td>
</tr>
<tr>
<td>Mats Stengård</td>
<td>Expert</td>
<td>Enigio</td>
<td>25-3-2019</td>
<td>Main</td>
<td>Personal</td>
</tr>
<tr>
<td>Lars Hansén</td>
<td>Expert</td>
<td>Enigio</td>
<td>25-3-2019</td>
<td>Main</td>
<td>Personal</td>
</tr>
<tr>
<td>Harri Rantanen</td>
<td>Company</td>
<td>SEB</td>
<td>27-3-2019</td>
<td>Main</td>
<td>Personal</td>
</tr>
<tr>
<td>Nils von Heijne</td>
<td>Expert</td>
<td>Superblocks</td>
<td>1-4-2019</td>
<td>Main</td>
<td>Telephone</td>
</tr>
<tr>
<td>Bernhard Szabowski</td>
<td>Company</td>
<td>Swedbank</td>
<td>2-4-2019</td>
<td>Main</td>
<td>Personal</td>
</tr>
<tr>
<td>Lasse Meholm</td>
<td>Company</td>
<td>DNB</td>
<td>5-4-2019</td>
<td>Main</td>
<td>Telephone</td>
</tr>
<tr>
<td>Henrik Olsson</td>
<td>Expert</td>
<td>PwC</td>
<td>8-4-2019</td>
<td>Main</td>
<td>Personal</td>
</tr>
<tr>
<td>Rufus Lidman</td>
<td>Expert</td>
<td>AIAR</td>
<td>8-4-2019</td>
<td>Main</td>
<td>Telephone</td>
</tr>
<tr>
<td>Interviewee 10</td>
<td>Company</td>
<td>Anonymous</td>
<td>11-4-2019</td>
<td>Main</td>
<td>Personal</td>
</tr>
<tr>
<td>Ville Sointu</td>
<td>Company</td>
<td>Nordea</td>
<td>12-4-2019</td>
<td>Main</td>
<td>Telephone</td>
</tr>
<tr>
<td>Matthew Scerri</td>
<td>Expert</td>
<td>KPMG</td>
<td>16-4-2019</td>
<td>Main</td>
<td>Telephone</td>
</tr>
</tbody>
</table>

5.3 Presentation of Interviewees

Table 4 describes each interviewee’s background and relevance in the study. The background is both on a personal level and on an organizational level as to show what their knowledge on the subject is.

**Table 4:** Interviewees and their background.

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altmann, Peter</td>
<td>Researcher for the non-profit organization <strong>RISE</strong>. Focuses on new technologies in relationship to value creation. Very focused on the technology behind <strong>Blockchain</strong> and what it actually is.</td>
</tr>
<tr>
<td>Hansén, Lars</td>
<td>Works at <strong>Enigio</strong> which is a company that was founded in 2012 and has since 2014 worked with different <strong>Blockchain</strong> applications. Extensive professional experience as Chief Risk Officer various positions in IT and in finance companies.</td>
</tr>
<tr>
<td>Name</td>
<td>Background and Role</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>von Heijne, Nils</td>
<td>Has had an interest in the technology for many years. Has worked actively with the technology for the last 1.5 years and is a partner of three companies that in some way are working with <em>blockchain</em>, <strong>Superblocks</strong> and <strong>Wishful</strong>, as well as works as an innovation advisor in a company within supply chain management.</td>
</tr>
<tr>
<td>Interviewee 1</td>
<td>Docent in Operations strategy. Researcher within strategies and operational competitiveness. Current research explores <em>blockchain</em> 4.0.</td>
</tr>
<tr>
<td>Interviewee 10</td>
<td>Has a background in data engineering and industrial engineering and management. Has worked 6.5 years for a large bank in Sweden with digitalization and innovation. More specifically, with innovation management and emerging technologies, for instance <em>blockchain</em>. Was the head of all <em>blockchain</em> related projects for the organization for two years, 2017-2018. The bank is decentralized and Interviewee 10 describes their attitude towards <em>blockchain</em> pragmatic. They have been active in numerous <em>blockchain</em> project but emphasize that without a clear business case that will create value for their customers, they are not interested in pursuing it.</td>
</tr>
<tr>
<td>Lidman, Rufus</td>
<td>Has been a leading digital strategist and has written a book about <em>blockchain</em>. Is now synthesizing leading insights from digital communication, education, AI, <em>blockchain</em> gamification and volunteer work. Has worked with organizational change in over 100 companies. Has written his dissertation on organizational change.</td>
</tr>
<tr>
<td>Meholm, Lasse</td>
<td>Has worked in the finance and securities market since 1986. Has worked with IT strategy, digital banking, <em>blockchain</em> and Fintech companies; 3 years in Nordea and now in <strong>DNB</strong>. Has also written a book about cryptocurrency, <strong>bitcom</strong>, ICO and <em>blockchain</em>. DNB as a company is part of 6-8 <em>blockchain</em> incentives, amongst others Marco Polo in which R3 and Corda are used. At the moment, <em>blockchain</em> is highly investigated as they see a possibility in that it could change the industry and they want to know how to position themselves; they see it as an investment in the future. All of the projects that they are in right now are using private, permissioned <em>blockchain</em> but are trying to figure out how to create a hybrid where the frontend to the customers is unpermissioned and the backend is permissioned.</td>
</tr>
<tr>
<td>Name</td>
<td>Experience and Roles</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Olsson, Henrik</td>
<td>Came across blockchain technology in 2011. From 2015, he worked with two blockchain focused organizations in New York. Since January 2018, he is in charge of all the blockchain services and transactions at PwC in Sweden. Has a wide perspective on research questions regarding the technology but is particularly knowledgeable on the subject of platforms and exchanges. PwC is a large consultancy firm focused on business consultancy, tax, and audit.</td>
</tr>
<tr>
<td>Rantanen, Harri</td>
<td>Works with large corporations and financial institutions with transaction services since 2007 at SEB. Has worked with blockchain since 2011. Is one of the founding members of the Trade Finance digitalisation community Standardized Trust. SEB as a company has attempted many blockchain technologies such as R3, Ethereum, and Corda. Has come a long way with Ripple payments internally but not externally. Has no cases in production but is testing many at the moment.</td>
</tr>
<tr>
<td>Scerri, Matthew</td>
<td>Has been interested in blockchain since 2013 and has been looking into it more deeply for 2.5 years. Is now the lead of cryptocurrencies and blockchain at KPMG Malta from a technical and software perspective. Has a background in software developing.</td>
</tr>
<tr>
<td>Sointu, Ville</td>
<td>Has worked with blockchain since 2013; then with financial services in emerging markets. He started realizing the potential of a blockchain network and of ledgers between institutions that are considered rivals. Since May 2017, he has worked as the head of blockchain at Nordea. He works for the center of excellence which focuses on emerging technologies, of which blockchain is one. Nordea is part of the we.Trade blockchain project which is the only bank driven blockchain project in the Nordic countries that is currently in production.</td>
</tr>
<tr>
<td>Stengård, Mats</td>
<td>Works at Enigio which is a company that was founded in 2012 and has since 2014 worked with different blockchain applications. Has 20+ years experience within IT, product development, and management. Experience from multiple sectors including the financial. Also specifically real time trading and exchange technology.</td>
</tr>
<tr>
<td>Szablowsli, Bernhard</td>
<td>Has worked with IT and system implementation questions for around 20 years, out of which the last seven at Swedbank as BIO - Business Information Officer - within large corporations and institutions. He is also responsible for the Global Transaction Services where trade finance is located. Swedbank has as a company worked with blockchain since 2016, with different experiments but has no current case in production. Amongst other areas, trade finance has been one of the main focused on but has not resolved into any blockchain solutions.</td>
</tr>
</tbody>
</table>
5.4 Data Analysis

According to Collis et al. (2009), there is no universally accepted set of conventions for analyzing qualitative data. However, they describe a widely used general analytical procedure for analyzing qualitative data. It is not tied to a particular data collection method, and will help in conducting the analysis in a systematic way. The procedure involves three simultaneous flows of activity: reducing the data, displaying the data, drawing conclusions, and verifying the validity of those conclusions. These activities take place both during the data collection and afterwards and are visualized in figure 17.

![Diagram of data analysis process]

Figure 17: Visual representation of the three steps and in the general analytical procedure described by Collis et al., (2009).

The first stage of the analysis process, data reduction, consists of selecting, discarding, simplifying, summarizing, and reorganizing qualitative research data. In this thesis, the data reduction has been of the type that Collis et al. (2009) calls continuous data reduction. This type of data reduction involves discarding irrelevant data and collecting data where relationships exist. This approach was chosen to pertain to the collection of rich data and allow for deep understanding of the phenomena.

As previously mentioned, all interviewees were recorded and listened to again after the interview. The authors of this thesis listened to the recordings and wrote down, independently, what they thought was important. This was done to achieve independent opinions and to make sure no information was lost. Then, the information was discussed and summarized in the results section of this thesis. Of course, this led to some data being ignored. However, this is part of the process. According to Collis et al. (2009), one has to be familiar with the data before one can determine what is relevant and what is not. This was achieved by the authors by re-listening, discussing, and summarizing the data. The data was restructured, which means that, with the use of the theoretical framework and insights gathered during the data collection, categories were created into which the data was fitted.
The next stage in the process is data displaying and is the process of summarizing data in a diagrammatic form that allows the user to draw valid conclusions. In this thesis, the data is not displayed as a network or matrix, as suggested by Collis et al., (2009). It is important to consider what appropriate displays can be used to bring together the qualitative data so that conclusions can be drawn (Collis et al., 2009). It was seen most appropriate to simply use text as it is displayed in the results section of this thesis; divided into themes based on the research questions and thereafter into the interviewee.

Lastly, the actual analyzing of the data is done. According to Collis et al. (2009), this process includes using parts of the interviews as examples of a particular "thing" that is of interest, adding comments and reflections, going through the material trying to identify similarities and differences, developing small sets of generalizations that cover the consistencies found in the data and linking these to the body of knowledge. This was done in the analysis part of this thesis.

5.5 Research Quality

According to Collis et. al. (2009), qualitative data usually results in findings with a high degree of validity. This is in contrast to quantitative data, that usually results in a high degree of reliability. Validity is to what extent a test measures what the researcher wants it to measure and the results reflect the phenomenon. Validity can be broken down into external validity and internal validity (Johnsson, 1997).

Reliability is the accuracy and precision of the measurement and absence of differences in the result if the research was to be repeated (Collis et. al., 2009). As previously stated, a qualitative study tends to result in a higher degree of validity than reliability. However, to achieve as high reliability as possible, the research has been thoroughly documented and descriptions of how the work was conducted is included. This is done by providing a clear set of references for all information used, as well as making sure that the way the data was collected can be clearly followed in the form of interview questionnaires and lists of interviewees and their backgrounds. In all cases but two, the names of the interviewees is provided resulting in a higher level of reliability.

Johnson (1997) states that when qualitative researchers aim to achieve validity, they want research that is plausible, credible, trustworthy, and therefore, defensible. As qualitative research tend to be open ended and less structured than quantitative research, a potential threat to validity is researcher bias, i.e. that researchers find what they want to find and allows their personal views and perspectives to affect how data is interpreted. This has, throughout the entire process of this thesis, been taken into consideration and the authors of this thesis have attempted to adopt an objective mindset and a critical self reflection. Also, as the results are separated from the analysis, the data gathered has been displayed with minimal interaction and interpretations and this contributes to the objectivity of the data.

Generalizability, also called external validity, concerns to what extent the findings can be extended to other cases or settings. It is possible to generalize from the chosen sample if the analysis has captured the interactions and characteristics of the phenomena (Collis et. al., 2009). In the case of this thesis, whether the conclusions can be extended to other cases and settings than the trade finance industry in the Nordic countries, is questionable.
Only banks operating in the Nordic countries and only one expert with origins from outside the Nordic countries were interviewed. As the context of the organization in which blockchain is to be implemented proved to be of importance, it is difficult to argue that the result will apply to trade finance industries in other countries. Also, it can probably not be argued that the results can be stretched to other industries, as the trade finance industry holds specific characteristics that make the implementation process unique. However, it could likely be argued that the results could stretch to other banks operating in the Nordic countries that want to implement blockchain technology in the area of trade finance.

Internal validity refers to the casual relationship between variables and results. It highlights the researchers’ ability to argue logic, defending the conclusions being made and its importance in the analysis. In other words, was the research done "right"? The qualitative researcher should take on the role of the detective; developing an understanding of the data through careful consideration of potential causes and effects and systematically eliminating "rival" explanations or hypotheses until the final case is made beyond a reasonable doubt (Johnson, 1997). Achieving a high degree of internal validity in this thesis is important, as blockchain is such a new technology and is developing quickly. To achieve a high degree of internal validity, it was of importance to find highly suitable and knowledgeable people and banks on the subject of blockchain. This is deemed to have been achieved as both top researchers on the area as well as banks that are among the biggest ones in the Nordic countries, including the only bank that actually currently have a blockchain consortium in production and available to customers, were interviewed. As some of the experts were not as knowledgeable on the area of trade finance, yet still highly knowledgeable on the area of blockchain, it was of importance to keep this in mind when analyzing the results, and adopt the role of the "detective" considering potential causes and effects, as previously mentioned.

Construct validity is the degree to which a test measures what it claims to be measuring. However, there is no single best way to study this type of validity and often construct validity can be demonstrated from a number of perspectives. The more strategies used to generate convincing evidence to demonstrate the high level of construct validity, the more confidence it gains. In short, it should be demonstrated by an accumulation of evidence (Brown, 2000). This was done by carefully designing the questionnaires to pertain to the research questions. It was also achieved by carefully deducting the analysis from the result and continuously supporting the statements in the analysis with references to paragraphs in the result. The conclusion was thereafter carefully deduced from analysis.
6 Results

In this section, the findings from the data collection are presented. First, the results of feasibility study are presented. The results of the main study are divided into two sub-categories based on the findings and the research question. The first category, Success Factors, pertains to answering the first sub-question: "What factors are critical for a successful implementation of blockchain in an organization?". The second category, Value Creation, answers the second sub-question: "What value does a blockchain create from a business perspective?". Under these sub-categories, the sections have been divided into the interviewees. All interviewees' backgrounds can be found in table 4. Lastly, the results from the questionnaires are presented.

6.1 Early Findings from Feasibility Study

The identified key words from the feasibility study interviews are listed in table 6, see appendix C. The findings from the feasibility study was that the finance industry is the furthest along when it comes to implementing blockchain technology. Other industries that were frequently mentioned were currencies and transportation. Cryptocurrencies were mentioned as the most well established example of blockchain technology today. The transportation industry is seen as having much potential, probably due to a project where IBM and Maersk have created a shipping solution using blockchain technology, but it became clear that this industry is not as far along as the finance industry. Other industries mentioned, either as examples where blockchain is being implemented or has potential to be implemented, were supply chain management, education, governmental institutions, donations, certificates, and insurances. When it comes to challenges for implementing blockchain technology, the interviewees had quite different views. Challenges mentioned were: finding a reason as to why implementing blockchain and not just use a database, amateurs and scammers, resistance to change, and the trade-off between starting big and then having difficulties building the system, or starting small and then having difficulties with trust and scalability. The reasons for implementing blockchain mentioned were: fear of falling behind, reducing costs, efficient transactions, increasing need for trust and transparency, and to have a joint data base structure without central control.

As previously mentioned, the aim of a feasibility study is to answer the question "Can this study be done?" and is used in this thesis to decide which industry to direct the research questions towards as a means to narrow down the scope. As the trade finance industry was found to be the furthest along when it comes to implementing blockchain technology, the decision was made to focus on this area and use it as the context of this thesis. The result from the feasibility study was also taken into consideration when constructing the questionnaires used in the main study.

6.2 Success Factors

In order to answer sub-question 1, "What factors are critical for a successful implementation of blockchain in an organization", the interviewees' responses pertaining to this research question have been summarized below.

6.2.1 Altmann, Peter - RISE

Peter Altmann makes a distinction between management commitment, support, and involvement. He believes that while support and commitment is of importance, management
involvement is very insignificant. He also argues that cross-functional groups should be formed so that people with a technical background and people with a business background can work together on forming a solution. Altmann claims that the context of trade finance implementation is not a technical problem in itself, but that implementation is characterized by the many regulatory demands in the industry.

6.2.2 Hansén, Lars - Enigio

Lars Hansén argues for the importance of using existing knowledge and competence in combination with interest for new technology in the organization, and further states that which factors are critical for success is more of a strategy question than a technical one. Many large organizations need to adapt their change management to legacy environments that are core to the business in order to maintain risks at an acceptable level. The importance of the different factors depends on who the decision-maker is and if the decision maker is receptive and constructive when reengineering processes. Hansén also claims that the difference between the implementation of blockchain and of other IT systems implementation, for instance the need for preparing the organization for a change, is not big. According to Lars Hansén, there are legal aspects that may be in conflict with a potential blockchain implementation as data in a blockchain can not be deleted. However, he also states that it is not the legal system that should be changed, but the blockchain technology that will have to be adapted to fit the legal requirements. Hansén states that it is of importance that the technology is well fit for its purpose, i.e. that the goal that is to be achieved more efficiently by using the technology. Hansén further states that a big problem in the world today is the lack of trust; in Sweden this may not be an issue but in many developing countries there is an issue with trusting governments agencies counterparties and banks and this is an area where blockchain has the potential to create value.

6.2.3 von Heijne, Nils - Superblocks and Wishful

Nils von Heijne believes that there are no differences on a structural level in implementing blockchain technology compared to other systems/processes. Von Heijne also claims that the least important success factor is an in depth understanding for the technology. He draws parallels to using internet; you do not have to understand how the actual technology works in order to use it in a way that creates value. He claims that a reason why an implementation could fail is lack of transparency of the implementation process and that the organization does not agree on the reason for implementing blockchain technology. It is important that it is clear which goal is to be reached and how the technology will be used to reach it. According to von Heijne, not many organizations are used to thinking from a fully decentralized and transparent perspective and he believes that this is the greatest challenge in implementing blockchain technology today. To succeed, it is important to dare to take the leap, have continuous discussion about the degree of transparency and decentralization, and to understand the value that these characteristics bring. Also, since blockchain is such a new technology, there is a lack of experience and knowledge about how to use it and implement it. Therefore, inexperience is probably a common reason for blockchain implementation attempts to fail.

6.2.4 Interviewee 10 - Anonymous Bank

Interviewee [10] states that there exists a belief that it is of more importance to pilot blockchain projects prior to full scale implementation than for other implementation.
However, [10] believes that piloting is not important as the success of the implementation depends greatly on the context and that it is more important to have an agile way of working. [10] emphasized that although being agile is an important factor in implementing blockchain, its importance is not restricted to blockchain projects. In distributed projects like blockchain, there are a number of events that can happen that are unique and one needs to understand these and take them into consideration. Today, actors in the trade finance industry are used to being in complete control of every transaction and this will not be possible in a distributed setting. For instance, from an anti-money laundering perspective, it is not possible to reach a 100% consensus between the actors in the network, but all actors must still be responsible for the possible consequences of a transaction. Many of these possible consequences could be difficult to predict and this is unique for blockchain projects. [10] argues that a common reason for failing is the lack of a good and realistic business case and further claims that having identified an issue that could be solved by using blockchain should be the way to go instead of trying to find a possible use case for blockchain. [10] acknowledges that a decentralized organizational culture may very well be an advantage when implementing blockchain technology. However, [10] does not believe that this applies specifically to blockchain but that it rather promotes innovation in general. The bank at which [10] works at does not apply a top-down approach, like most other big banks, and this means that essentially anyone in the organization could decide to use or implement blockchain. This creates a discussion regarding decentralized autonomous organizations; how to establish decentralization in a digital structure so that it is not possible to centralize it. [10] sees trade finance as an interesting case but identifies a few issues, mainly how to handle the fact that the data comes from people that may not be trustworthy. For instance, one can not guarantee that a harbour or other middlemen in the value chain puts accurate information on the blockchain. A blockchain solution may seem like a good idea for the end actors of a value chain but the middlemen might not see the point in it and therefore not use it correctly.

6.2.5 Lidman, Rufus - AIAR

An important factor for a successful implementation of blockchain technology is according to Lidman clear management support and commitment. This is due to the disruptive character of the technology that sets it apart from many other implementation processes; the more disruptive the technology, the bigger the resistance to change will be. Lidman states that if an organization has a very centralized culture, the resistance will be even greater. The resistance may also be enhanced by failed attempts of implementing blockchain as is very common for new technologies. Due to this, it is very important to root the change with everyone who has something to lose by it. Another factor in order to succeed is understanding the local prerequisites in the organization and to adjust the system accordingly. Alike most other implementation processes, piloting the project is important to generate success stories that can be spread within the organization for internal advertisement purposes. For the same reasons, it is not important to keep the change transparent to the entire organization from the very beginning but; it could rather be beneficial to work below the radar. A risk with communicating the change too early is the creation of resistance to the change. This also connects to the factor regarding employee training and education; not all employees need to be educated on every aspect of the implementation. Lidman states that an extensive project definition and planning is insignificant since the more one plans ahead, the more one will have to adapt the process due to changes. It is more important to keep an agile way of thinking and working as well as analyzing the success of the process using data. Blockchain implementation is not an internal project as the very
nature of it requires all actors to be involved. Lidman further claims that an in depth understanding of blockchain technology is only important for the developers of the system; for others in the organization it is rather important to understand how the change will affect how they work and what the consequences are for the customers and the business. The goal of the project is however important for everyone in the organization to be aware of, as all employees should want to strive to collectively reach that goal. A cross-functional integration is of utmost importance, and is required both within the organization but also externally. Lidman argues that system quality is very dependent on the context; sometimes a well developed system could work against a successful implementation as it obstructs the creativity and change of the system to adapt to the organization. Lidman also argues that it is the transaction that the database enables rather than the database itself that creates value.

6.2.6 Meholm, Lasse - DNB

According to Meholm, blockchain has a higher level of teamwork than other systems/processes. Meholm uses the Marco Polo project as an example, which is a project executed alongside many other banks and this high level of cooperation between banks is not commonly seen in the finance industry. This of course requires better ways of communication. To agree on the next step in these projects therefore takes a lot of time and the time scale becomes an issue in implementing blockchain. Meholm also identifies scalability as a challenge. There are so many projects of equal size going in parallel that are doing more or less the same thing, which may be an issue in the future unless an actor starts building bridges between them. Meholm also acknowledges that the trade finance industry carries a strong legacy.

6.2.7 Olsson, Henrik - PwC

Henrik Olsson emphasizes that for blockchain implementation, it is especially important to recognize that there are several organizations that work together, not just one as is the case in most other implementation efforts. In regards to the factors in the rating questions (see appendix I), "Clear management support/commitment/involvement of the implementation", "Understanding of the organization in which the implementation is to take place (its strengths, needs etc.)", and "Keeping the change communicable and transparent within the organization", are especially important to have in mind according to Olsson. He also mentions that for the factors "Keeping the change communicable and transparent" and "Employee training and education", it differs in different parts of the organization. Olsson also acknowledges that most factors received high rating from him, and he thinks that they are all important in order to ensure a successful implementation.

As opposed to other implementation processes, the complexity of a blockchain implementation brings about a few specific issues that stem from the fact that several organizations have to cooperate in the process. For instance: who should have writing, reading, and audit rights. Also, who should be responsible for new releases, maintenance, and payments. These issues are important to be addressed as the value chain evolves from centralized to decentralized. There is also a regulatory aspect of the implementation of blockchain technology that adds to the complexity of it. There is an issue in how to be able to trust that the other actors do not act dishonest. Therefore, it will be of importance to do pilot projects to test the use case. It is also of importance to have an in depth understanding of the standardization that will happen in the processes/transactions. Olsson also emphasizes
the need to cooperate in a more distributive manner than is done today. It is completely
new and unique for organizations using blockchain to cooperate in the large scale that will
be necessary. Many business models today are not fit for this new way of working; today,
everyone is used to doing their own thing and charge the customers for that. Another
issue that Olsson identifies is the communication between different blockchains if different
blockchains are used.

Olsson identifies a lack of a trust issue as a possible reason for an implementation of
blockchain technology to fail because then there is no need for using a blockchain. An-
other possible reason for failure could be that the project is not scoped properly, i.e. that
the organization tries to start with implementing too many features at once. Olsson ar-
gets that yet another reason for failure is underestimating the cost of the implementation.
Also, it is common to forget the end user and to acknowledge the end users’ needs in the
product strategy. Olsson also claims that if the organization has a history of failed projects
or is not experimenting with new technology, then it is not likely that it will succeed in
implementing blockchain technology either.

6.2.8 Rantanen, Harri - SEB

To Harri Rantanen, an important success factor is management support and management
understanding as the technology is so new. However, he does not believe that the same
understanding is necessary throughout the organization as the technology is very difficult
to explain. Piloting is also very important due to the fact that the technology is so new
that many proof of concepts do not end up working. Rantanen believes that a reason to
why a blockchain implementation might fail could be due to resistance and skepticism of
the technology from the compliance and risk departments. It is very important to have a
low risk, and therefore blockchain might not be viewed as the optimal solution. He also
emphasizes that in order to succeed with an implementation of the technology, it has to
create value in some way. The reason a lot of PoC fail to be implemented is that they
are not actually needed and do not create value. Another reason for failure may be that
the technology is used to try to solve something that is not actually needed and could just
be removed instead. However, Rantanen also claims that depending on which blockchain
technology that is used, the implementation process differs.

6.2.9 Matthew, Scerri - KPMG

Matthew Scerri states that one should not view blockchain as a database and that imple-
menting blockchain with the intention of using it as such will never succeed. Blockchain
does not in itself store data; it is the ledgers that store transactional information. Scerri
stresses the importance of management involvement from all stakeholders involved as a
blockchain by default involves several organizations and it is crucial that the leadership
is equally strong from all actors. The same goes for understanding of the organization in
which the implementation is to take place; it is also necessary to comprehend how these or-
ganizations interact and transact data between each other. This also pertains to extensive
project definition and planning as well as involving all stakeholders; unless everyone is on
board, the implementation will not be successful. Not only is it important to acknowledge
the different actors, it is also important to have a clear definition of how different parties
are going to interact with each other. Scerri pinpoints that a blockchain is only as strong
as the community behind it; if the end users do not want to use the solution, it will of
course not be successful. Another thing mentioned is resistance to change; some people
are inherently resistant to change but will get on board once they see the benefits of the implementation. In the end of the day, people will use a solution if it brings tangible benefits to them.

Scerri points out that piloting is not as crucial for blockchain implementation projects as for other projects. This is due to the fact that a PoC is a way of piloting. He also emphasizes that not all employees need to have an in depth understanding of the technology. People need to understand how the implementation of blockchain will affect their work, but not how the actual technology is set up. Scerri mentions that there is a need for performance measurement and data analysis in determining if there is a need for blockchain, but once blockchain has been decided upon, the measurement is inherent within the system. Scerri identifies scalability as the current largest hinder for blockchain solutions.

6.2.10 Sointu, Ville - Nordea

Sointu argues that there is a need to separate the management of the bank from the management of the network. Clear management support is important in both cases, but especially important within the bank. Without the support of the management of different units, for instance the head of trade finance, the blockchain solution would never leave the innovation and PoC phase. Sointu states that change itself should never be the driving force of implementing blockchain; the goal should always be to increase customer value and to create better service. As blockchain is such a new technology, piloting a project is of great importance as of now. However, in the future so many implementations of blockchain will have been done that piloting will not be important. In depth understanding of the technology is not crucial for everyone in the organization, only a handful of people are needed to fully understand it in order for the organization to create value from it. Even though financial services of course can not compromise on reliability and security, Sointu recognizes that there are issues in emerging technologies that cause non-security related compromises to be made initially.

Sointu makes a distinction between implementing and building the technology and connecting it to an already existing blockchain network. In the first, he recognizes that it will take a lot longer as the distributed nature of the technology means that many different parties have to reach consensus concerning decisions in the process. However, he also argues that the long term benefits of building a decentralized network will outweigh the time consuming implementation process. The most common reason for a blockchain implementation to fail is that one does not involve the business unit or run the necessary compliance tasks. It is easy to do a PoC and even to build a prototype, but where most implementation efforts fail is in the commercialization of it. People tend to underestimate the complexity of that last stage. For the trade finance context, it is especially important to scope who the network is intended for, both geographically and for which size of organizations as these have different needs and operate differently. If one tries to start too big, the complexity will be too much; one should rather start small and then scale. Some blockchain projects that are up-and-running started with a global focus but have been forced to scale down instead.

6.2.11 Stengård, Mats - Enigio

Mats Stengård states that among the critical success factors in appendix H, none can be said to be insignificant. Specifically mentioned was that the factor "An in depth un-
standing of the technology that is to be implemented; what it is and how it works" is not very important except for system architecture. He also pointed out that the organizational setting and culture will have a big impact on the implementation. Especially important is that existing knowledge and competence in an organization is acknowledged and used. Stengård also mentions that blockchain should simply be seen as a new type of technical component or tool that can be used in the quest to solve business problems and make processes more efficient. He thus argues that it is important that the implementation of blockchain technology in an organization intends to actually solve an actual problem where current IT tools and solutions will not work. It does not create value to try to solve an issue with blockchain that already has a well working solution. He also says the blockchain hype seems to forget that most of the building blocks and reasoning behind blockchains and DLT are well proven and old, the release of bitcoin created new spotlight on the possibilities with this technology.

6.2.12 Szablowski, Bernhard - Swedbank

Szablowski recognizes management support to be an essential condition for implementing blockchain technology. He states that the second success factor, well established motivation for change, will differ depending on how much the implementation will affect the daily work. The bigger the change for the employees in their daily life, the more important it is. He believes that communication around the implementation is very important as well as feels that it is something that is often forgotten. Communication is often focused on the people who is directly affected by the change but it is of equal importance to communicate the change to other parts of the organization, especially if the implementation is successful. Szablowski states that employee training and education is important but is skeptical towards theoretical education and believes more in learning by doing. He also believes that extensive project planning and definition is highly irrelevant since it creates a stigma and the project will never take off. He finds understanding of the technology rather insignificant and compares it to the internet; you do not have to understand it in order to successfully use it. He also believes that initially system quality is of lesser importance, but that this becomes more and more important as the implementation goes on. Szablowski believes that the biggest reason for failure in implementing blockchain and other technologies is that one forgets the human factor. He believes that too much weight is put on the technology itself and that the psychological factors including people feeling scared or worried are forgotten. In order for the solution to take off, it has to solve an existing problem and has to fill a human need as well as have a high level of user friendliness. Another problem with blockchain implementation within trade finance is that the trade finance industry has looked pretty much the same for a long time and there is hence a resistance to change.

6.3 Answers to the Rating Questions

In order to get a deeper understanding of the interviewees’ answers in the main study pertaining to sub-question 1 regarding success factors, the answers to the rating questions in the main questionnaire, see appendix H, have been summarized below.
Table 5: Results from the rating questions.

<table>
<thead>
<tr>
<th>Success Factor</th>
<th>Bank</th>
<th>Expert</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear management support/ commitment/ involvement of the implementation</td>
<td>4.2</td>
<td>4.4</td>
<td>4.3</td>
</tr>
<tr>
<td>Well established motivation for the change throughout the organization, i.e. there is a sense that change is needed and necessary</td>
<td>3.4</td>
<td>4.3</td>
<td>3.9</td>
</tr>
<tr>
<td>Understanding of the organization in which the implementation is to take place (its strengths, needs etc)</td>
<td>3.4</td>
<td>4.9</td>
<td>4.3</td>
</tr>
<tr>
<td>Piloting the implementation process prior to full scale implementation, as a way to gather insights</td>
<td>4</td>
<td>4.2</td>
<td>4.1</td>
</tr>
<tr>
<td>Keeping the change communicable and transparent within the organization</td>
<td>3.8</td>
<td>3.6</td>
<td>3.7</td>
</tr>
<tr>
<td>Employee training and education</td>
<td>3.8</td>
<td>3.7</td>
<td>3.8</td>
</tr>
<tr>
<td>Extensive project definition and planning</td>
<td>2.8</td>
<td>4.3</td>
<td>3.7</td>
</tr>
<tr>
<td>Managing and involving stakeholders (for instance customers and suppliers)</td>
<td>4.4</td>
<td>4.6</td>
<td>4.5</td>
</tr>
<tr>
<td>An in depth understanding for the technology that is to be implemented; what it is and how it works</td>
<td>2.6</td>
<td>3.9</td>
<td>3.4</td>
</tr>
<tr>
<td>A clear and communicated goal of what is hoped to be achieved by implementing the technology</td>
<td>3.2</td>
<td>4.9</td>
<td>4.2</td>
</tr>
<tr>
<td>Cross-functional integration between different areas within the organization</td>
<td>3.2</td>
<td>4.4</td>
<td>3.9</td>
</tr>
<tr>
<td>Performance measurement and data analysis, i.e. regular measurement of outcomes and results to generate reliable data that can be used for analyzing the implementation and assess if it is working well</td>
<td>3.6</td>
<td>4.0</td>
<td>3.8</td>
</tr>
<tr>
<td>System quality, i.e. scalability, robustness, dependability, etc.</td>
<td>3.2</td>
<td>4.6</td>
<td>4.0</td>
</tr>
<tr>
<td>Total average</td>
<td>3.5</td>
<td>4.3</td>
<td>3.9</td>
</tr>
</tbody>
</table>

The individual responses to the rating questions are displayed question by question in appendix J.

For the interviewees in the bank category, the most important factors proved to be "Managing and involving stakeholders (for instance customers and suppliers)" and "Clear management support/ commitment/ involvement of the implementation". The least important factors according to them are "An in depth understanding for the technology that is to be implemented; what it is and how it works" and "Extensive project definition and planning".

For the interviewees in the expert category, the most important factors are "Understanding of the organization in which the implementation is to take place (its strengths, needs etc)" and "A clear and communicated goal of what is hoped to be achieved by implementing the technology". The least important factors were to them "Keeping the change communicable and transparent" and "Employee training and education".

The generated averages for the entire group of interviewees proved that the most important factors considering both banks and experts, were "Managing and involving stake-
holders (for instance customers and suppliers”, “Clear management support/commitment/involvement of the implementation”, and “Understanding of the organization in which the implementation is to take place (its strengths, needs etc)”. The least important factors were “An in depth understanding for the technology that is to be implemented; what it is and how it works”, “Keeping the change communicable and transparent within the organization”, and “Extensive project definition and planning”.

In general, the interviewees from the bank category rated the factors lower than the interviewees from the expert category, as can be seen by the generated total average.

6.4 Value Creation

In order to answer sub-question 2, ”What value does a blockchain create from a business perspective?”, the interviewees’ responses pertaining to this research question have been summarized below.

6.4.1 Altmann, Peter - RISE

Peter Altmann states that there is an issue with trust in developing countries. In Sweden, there are regulations in place that will not allow for the same kind of disruptive changes that may be possible in developing countries. Furthermore, he argues that much of the implementation efforts of blockchain today are digitalization projects or aim to automate processes. However, this is not where the true disruptive power of blockchain lies, but this will not be realized in many years. Altmann further claims that the value of blockchain comes from the fact that it enables people with different backgrounds and power to join forces and solve issues that should have been solved long ago. Another source of value creation is that the technology facilitates large investment, as blockchain is seen to be an up-and-coming technology. He also says that by defining a blockchain implementation as a means of attempting to reach a bigger purpose than the actual technical implementation, it is impossible to fail with the implementation. Altmann argues that the future potential of blockchain is as impossible to picture as it was for the future potential of internet to be visualized when it was first launched.

6.4.2 Hansén, Lars - Enigio

According to Lars Hansén, there is a significant value in that implementation of blockchain technology removes the need for trust between actors, as the blockchain is the third trusted party where confidentiality is important. Furthermore, blockchain technology is well suited for areas where there are issues with trusting authorities which may be the case of some actors in the trade finance value chain. In the case of how Enigio applies cryptography and distributed ledger technology, there is also a value in that the digital documents are readable both for humans and computers; the automation will of course save money but can be controlled and managed manually by people.

6.4.3 von Heijne, Nils - Superblocks and Wishful

According to Nils von Heijne, it is the combination of security, transparency, and decentralization that sets blockchain technology apart from other databases. He believes that value is created thanks to the sense of security that is created for all involved, including, but not limited to, users. However, he does see that sometimes blockchain is implemented even though a regular database is more suitable simply because there is a hype surrounding the
technology. However, he sees a value in that blockchain can create discussion and that it will foster communication and problem-solving. Nevertheless, it is important to be aware that this is a short-term solution.

6.4.4 Interviewee 10 - Anonymous Bank

Interviewee [10] states that blockchain enables collaborations between banks and a change in attitude towards working together. [10] claims that the main value in blockchain stems from the creation of trust and that one can create things that would have previously been very difficult to trust. [10] compares the technology to a map of interactions that clarifies who can do what and when. Despite that many believe blockchain is a "silver bullet" that will solve all problems, [10] does not see it creating value today. However, [10] does believe that there may be potential for it in the future, but that neither the technology nor society are mature enough yet. Also, the hype around blockchain can create value simply through the advertisement of one using it, although this is not how the anonymous bank works. In the future, the fact that the market is so segmented might become a problem with regards to trust; a new infrastructure that allows for trust needs to be built so that the bank remains relevant in a digital context. [10] means that they, as a bank that is well trusted, can remain relevant even in the future by creating a semistructured infrastructure with both a permissioned and a permissionless part. Blockchain is not by itself a solution for the trade finance industry, but needs to be combined with other technologies in order to truly create value. Comparing blockchain to the internet is not something that [10] believes in, but recognizes that only the future holds the truth.

6.4.5 Lidman, Rufus - AIAR

Rufus Lidman argues that it is the transaction that the database enables rather than the database itself that creates value. In regular databases, data is only stored and not transacted. The traceability, no need for a central database, and the peer-to-peer interaction are what blockchain technology brings that stand out. Lidman also emphasizes that the security in the transactions, along with the possibility to track the transactions and the inability to fake them are important factors for value creation. Especially within trade finance, the transparency of a blockchain database is a key value creating factor. Furthermore, the high speed of transactions and the increased knowledge spreading are two specific characteristics that blockchain will bring for the trade finance industry. Lidman also acknowledges that there is a difference between incremental changes and innovative changes; so far, there has not been any innovative change in trade finance, but there is great potential.

6.4.6 Meholm, Lasse - DNB

According to Lasse Meholm, blockchain technology has the possibility to change the future of their businesses and states that it is important to investigate how they can position themselves in the area. Meholm believes that there is a great possibility to save money by replacing some old and inefficient systems. He believes that blockchain could be the solution to some of the existing problems but not all; there are a number of elements in the technology that are really unique and there is hope of being able to leverage from these. For instance, it can enable faster and cheaper payments for their customers. In the end, what it boils down to is the ability to save money and provide better service for their customers.
6.4.7 Olsson, Henrik - PwC

According to Henrik Olsson, the value in blockchain technology stems from building trust. Today, it is expensive to build trust and the blockchain technology has the potential to automate this and thereby save costs. This will promote the creation of new services and products, for instance for insurances. Another important part of the technology is the time stamping it provides and that it enables digital book-keeping. Olsson acknowledges that there are many bad use cases but also many with great potential. Olsson also sees an issue in the interface between the physical and the digital world; one of the main value creating factors is the end-to-end digitalization of the value chain that blockchain can bring. This is especially important in trade finance, for instance, how different harbours may have not come equally as far as each other in their digitalization efforts. However, a requirement for this to work is that all actors are connected to the blockchain or else the value is not obtained. According to Olsson, the value of blockchain in trade finance stems from facilitating multiple actors to cooperate on one platform. Today, a large part of the processes in trade finance are manual.

6.4.8 Rantanen, Harri - SEB

According to Harri Rantanen, blockchain technology is not suitable in all areas within the finance industry. From experience, he knows that many of the PoCs fail to be implemented and work as intended. However, he believes that there is great potential for the technology in the area of trade finance. This is not to say that there are not issues that will have to be solved; as of now, using a central database is quicker than having the distributed database that blockchain technology is based on and as latency is often an important factor in finance, this is something that speaks against the use of blockchain. The true value is the reduction of middlemen and the increase in trust between parties, as well as there is no room for interpretation in contracts. Furthermore, there is no need to monitor transactions as you can trust that once an account has been charged, another is immediately credited. Rantanen also states that blockchain opens up for the possibility of smaller companies to take part of the trade finance instruments as these have previously been very expensive and there are lots of issues of trust between smaller companies and banks. The risk for monopolies is also reduced as the control is distributed. Rantanen also claims that having no central database could be seen as a threat towards banks as these have previously been used as a central point of trust, but believes that this challenge is a positive one. Less experts and less personnel for administrative tasks are needed as the blockchain would take care of these tasks itself and the personnel can instead work with development and follow-up tasks. The knowledge of the blockchain technology is much easier to access than the knowledge of many other systems used in the finance industry. Rantanen states that this has to do with open-sourcing; the code is available to anyone and the communities that are thereby formed. These communities promote cooperation and exchange advice and experiences with each other and this results in faster integration. The systems that are used in the finance industry today are protected with legacy and because of this, relationships to key people with the correct information are of essence to get the same kind of exchange of knowledge as blockchain communities provide.

6.4.9 Matthew, Scerri - KPMG

Matthew Scerri argues that implementing blockchain makes sense when there are multiple parties involved that operate independently but want to work together. Scerri also mentions trust, automation, and efficiency as value creating factors. Traditionally, systems
used in trade finance do not interact with each other easily as one usually only wants to expose proof of that one has done something and not the information itself.

6.4.10 Sointu, Ville - Nordea

Ville Sointu states that trade finance is an obvious use case for blockchain, the industry is heavily paper-based and there are many possible digitalization efforts that can be made. Sointu argues that automating some parts of the value chain could create value, but that using a permissionless blockchain is not an alternative for banks as they would lose the control of their customers. The risk of using a permissionless blockchain is impossible to determine and the banking industry is by default based on one knowing who their customers are, which presents a risk. Sointu points out that a blockchain is suitable when there are many actors involved as data privacy is ensured and one does not have to worry about complexity. Another advantage of a distributed database is the robustness of the system; if one bank goes down, the system as a whole will still remain up. Also, network expansion is not difficult and joining the network essentially only requires a node. Sointu argues that one of the main value creators of blockchain is the shift of mindset of banks. Previously, there has been a fundamental problem with getting banks to work with competitors but simply the conversation starter that blockchain is creates a drive for them to do so. Value is not created by all banks doing the same thing within their own walls - simply replicating a process - but through building a collaborative space. However, Sointu also states that it is of importance do define where this collaboration begins and ends since this is where banks can create their competitive advantage.

6.4.11 Stengård, Mats - Enigio

According to Mats Stengård, there is value in the trust that comes with the technology. Compared to other databases, blockchain creates trust by the use of mathematical cryptographical security. According to him, banks are in general built on trust and have for a long time been trying to digitalize promissory notes - a document containing a written promise to pay a certain sum to a person or the bearer at a specified date or on demand. However, they have not been successful and blockchain is used as an enabler to solve this problem.

6.4.12 Bernhard Szablowshi, Swedbank

According to Bernhard Szablowshi, there are a lot of possibilities when it comes to blockchain technology, but there is a lack of successful use cases. Swedbank did investigate trade finance and blockchain but had difficulties identifying the actual value that would be created by implementing such a solution. Szablowshi sees a lot of risks with blockchain. One of these is money laundering as there is an issue with making sure that only trustworthy people will join the blockchain. Another risk is the need to be able to trust the person that one is buying from and there is an insecurity in how blockchain could handle this. One of the benefits that blockchain technology provides is secure communication. However, there are already systems in place for this so implementing blockchain does not solve a problem in that aspect. Szablowshi is also skeptic about the security of the blockchain he means that it is likely that hackers will find a way to get around even the high level of security that blockchain brings. Szablowshi believes that implementing blockchain will not actually reduce the costs for the bank since there will still be a need for several systems to be in place due to regulatory issues. The bank will have the cost of their own system
and the cost of connecting to the distributed ledger. Szabolosshi argues that there is such a small chance that Swedbank would be the company to develop a solution for this and therefore they are not working actively with it. Also, if such a solution would be presented, then trade finance within banks would be obsolete. Szabolosshi claims that in developed countries, there are already well-working systems for trade finance, and the real issue is in trading with developing countries. Szabolosshi is however not sure that blockchain would solve these issues either. Szabolosshi sees that the security, the increase in efficiency, and the clarity of what is actually true are what sets blockchain apart from other databases.
7 Analysis of the Results

In this section, the results will be analyzed. The analysis has been divided into two sub-categories based on the findings and the research sub-questions. The first category, Success Factors, pertains to analyzing the answers to the first sub-question: "What factors are critical for a successful implementation of blockchain in an organization?". The second category, Value Creation, analyzes the results of the second sub-question: "What value does a blockchain create from a business perspective?".

7.1 Success Factors

In order to answer sub-question 1, "What factors are critical for a successful implementation of blockchain in an organization?", the interviewees’ responses pertaining to this research question have been analyzed below. From the results, five areas of interest have been specifically identified. These are the key subjects that have been discussed by the interviewees and are therefore particularly interesting to analyze. The first area regards the role of collaboration. The second area is that of regulatory obstacles. The third is on the fact that blockchain needs to solve an existing issue in order for an implementation to be successful. The fourth area concerns how the context comes into play for a successful implementation and the fifth regards the problem of resistance to change within an organization. Lastly, an analysis of the answers to the rating questions is presented.

7.1.1 The Role of Collaboration

This topic was the most mentioned among the interviewees, both by banks and experts (see 6.2.3, 6.2.4, 6.2.5, 6.2.6, 6.2.7, 6.2.9, and 6.2.10). One of the unique features of a blockchain implementation, as it is a distributed database, is that its very nature requires all actors to be involved. Many interviewees argue that therefore, it is important to recognize this and to understand how it will affect the implementation process. Today, especially in the trade finance industry, many actors are used to thinking and acting from a centralized perspective and cooperation between banks is not commonly seen. Actors in the trade finance industry are also used to being in complete control of every transaction and this will not be possible in a distributed setting. This may make the implementation process longer, as many parties have to reach consensus concerning decisions in the process. For instance, one interviewee (see 6.2.7) mentions the questions of who should have writing, reading, and audit rights and who should be responsible for new releases, maintenance, and payments, as time consuming.

If a blockchain implementation is to be successful, all actors in a value chain thus have to be connected to the network. Using a blockchain may seem like a good idea for the end users, but the middlemen may not agree and thus use it incorrectly; one interviewee (see 6.2.9) specifically explains that a blockchain is only as strong as the community behind it. Also, it has to be ensured that the information that is put on the blockchain is accurate, and it is therefore important that all actors use the blockchain correctly in order for it to be successful.

7.1.2 Taking Regulatory Obstacles into Consideration

There is also a regulatory aspect that adds to the complexity and has to be taken into consideration, mentioned by multiple interviewees (see 6.2.1, 6.2.2, 6.2.4, 6.2.7, 6.2.12).
According to the theoretical framework on technology diffusion, the government may create laws and regulations that hinder organizations from full implementation (Hall et al., 2003). However, for blockchain it is not new laws that are being made, but rather the already existing laws that hinder the implementation of the technology. This is confirmed by the theoretical framework on blockchain in trade finance (Long, 2017); there is a large diversity over the globe and not all jurisdiction has come as far in validating electronic signatures and thus require paper documents. As a fundamental requirement for blockchain is that all users are connected to the network, this is an obstacle for implementing blockchain technology in an organization within trade finance. Typically, a value chain within trade finance involves many actors and there are a lot of middlemen. The use of blockchain technology is most valuable for the end actors of the value chain which may result in incorrect usage by these middlemen. However, by the theory on the benefits of blockchain technology (Drescher, 2017), the need for these middlemen will be reduced and this problem may not be a problem in the future when blockchain technology has evolved even further. Another issue is that, from an anti-money laundering perspective, it is not possible to reach a 100% consensus between actors in the network, but all actors must still be responsible for the possible consequences of a transaction (see 6.2.4, 6.2.7, and 6.2.12). There is thus an issue on how to be able to trust that the other actors in the network do not act dishonestly. One interviewee (see 6.2.2) argues that there are many legal aspects that may be in conflict with a potential blockchain implementation. However, the interviewee also claims that it is not the legal system that should be changed but rather the technology. This confirms what was found in the theoretical framework on blockchain 2.0: smart contracts (Manski, 2017); it will be nearly impossible to control the smart contracts using existing law and this will require that the parties agree on incorporating the legal framework into the code. Regulatory obstacles have also been identified as one of the main factors holding the adoption of blockchain back (PwC, 2018), as seen in the theoretical framework on blockchain implementation efforts. It is therefore important to be aware of and have a deep understanding of how the regulatory obstacles may come to affect the implementation so that one can be prepared.

7.1.3 Solving an Existing Issue

Mentioned by almost all interviewees (see 6.2.3, 6.2.4, 6.2.7, 6.2.8, 6.2.10, 6.2.11, and 6.2.12) was that blockchain is often implemented even though a regular database is more suitable. This has shown to be one of the main reasons that a blockchain implementation is unsuccessful; without an existing issue that blockchain is suitable for solving, there is simply no need for the technology and an attempt to implement blockchain anyway will be unsuccessful. If the problem that one wishes to solve using blockchain is not an issue concerning trust, then another database is more suitable (see 6.2.7). One interviewee (see 6.2.10) specifically claims that it is easy to do a PoC and even to build a prototype, but where most implementation efforts fail is in the commercialization of it because people tend to underestimate the complexity of that last stage. This is in accordance with the theoretical framework on blockchain implementation (Drescher, 2017); according to his framework, it needs to be decided whether a certain blockchain application is useful and creates a tangible value before one tries to implement it.

Furthermore, if the issue is not scoped properly and an organization tries to start with implementing too many features at once, there is a big risk for failure (see 6.2.4, 6.2.7, and 6.2.10). Also, if the solution does not pertain to the end user’s interests, it will not bring value and thus fail. Two interviewees (see 6.2.5 and 6.2.9) particularly mention that view-
ing blockchain as a database is a reason for failing with the implementation; blockchain does not in itself store data but it is the ledgers that store transactional data. Change itself should never be the driving force of implementing blockchain; the goal should always be to increase customer value and create better service (see 6.2.10). This is in accordance with the theoretical framework on critical success factors; increasing customer service is identified as a value creator that results in competitive advantages for the organization (Bullen et al., 1981; Corkindale, et al., 2013).

7.1.4 Adapting to the Context

As described through contingency theory (Fixsen et al., 2005), the CSFs for an implementation are greatly affected by the context (see 6.2.5 and 6.2.11). It cannot be said that a factor is important for all implementations in all organizations. Which factors that are important should be seen as a strategy question rather than a technical one (see 6.2.2). One thing that specifically differed between the interviewees was their opinion on how much the implementation process of blockchain differs from implementation of other systems; while some argue that the distributive nature of the technology will require a completely new way of working (e.g. 6.2.4, 6.2.6, and 6.2.7), some state that there are no differences on a structural level (e.g. 6.2.2 and 6.2.3). This could be dependent on what type of change is happening; as seen in the theoretical framework on dispositional resistance to change (Fosfuri et al., 2009); incremental changes meet less resistance than radical innovation and therefore these may need different approaches for implementation. Understanding of the local prerequisites in the organization and the ability to adjust the system accordingly is hence crucial. The implementation process also differs depending on which blockchain technology that is used. The importance of the context in specifically a blockchain implementation was only mentioned by two experts (see 6.2.5 and 6.2.11). This is likely due to the fact that the interviewees in the expert group had a more generalized view on a blockchain implementation than the interviewees belonging to the bank group, who are most likely more focused on the implementation efforts within their own organization.

7.1.5 Managing Resistance to Change

According to several of the interviewees (see 6.2.5, 6.2.6, 6.2.9, and 6.2.12), the bigger the disruptive character of the technology, the more resistance to change. This was confirmed by the theoretical framework on dispositional resistance to change (Fosfuri et al., 2009). Since blockchain has been identified as a disruptive technology, there is potential for large resistance to it and this sets it apart from many other implementation processes. One interviewee (see 6.2.5) argues that if an organization has a very centralized culture, the resistance to change will be greater. However, when asking one of the banks that has a decentralized organization culture, this was not agreed upon (see 6.2.4). The bank rather identified the decentralized culture as an enabler for all innovative changes. This is in accordance with the theoretical framework on contingency theory (Roering, et al., 1985); organizations with organic structures, meaning that there is a low level of formalization and centralization, are more effective in regards to innovation, flexibility, and adaptiveness. However, it was also found that having a culture that supports internal entrepreneurship (as a decentralized culture does) has proven to be of importance when implementing blockchain technology to avoid the feeling that the new implementation deviates from the core functions (Du, et. al., 2018). Taking all this into consideration, no conclusion can be drawn about whether or not a decentralized culture is more important for implementing blockchain than for any other innovative project or implementation only that it is of importance for both.
Resistance to change may also be created through keeping the change too transparent within the organization; as the technology is so new it might have a fearful impact on some employees since the technology requires a high level of technical understanding. For example, skepticism may exist in the compliance and risk departments. Several interviewees (see 6.2.5, 6.2.6, 6.2.9, and 6.2.12) argue that it is better to not keep the change transparent to begin with and rather to wait until positive results could be shared with the organization, as a way to avoid resistance to change. This is in accordance with what could be expected; resistance to change is identified as one of the most common reasons for failing to implement lean and implementing lean may end up having a disruptive effect (Achanga, et al., 2006), much like blockchain.

Some interviewees (e.g. 6.2.4 and 6.2.6) recognize that the trade finance industry holds a strong legacy, which is supported by the theoretical framework on trade finance (Chandna, et al., 2017). The strong legacy combined with the very manual and paper-heavy characteristics of the industry creates resistance to change. Many digitalization efforts are made and banks like talking about digitalization, but the number of actual participants in digitalization efforts is surprisingly low (Long, 2017). Theory on blockchain implementation (Du, et al., 2018) state that the corporate strategy of digitalization is important as a technology’s alignment with the corporate strategy is an important success factor in technology implementation. While this was not mentioned by the interviewees, it is important to recognize the characteristics of the trade finance industry in order to successfully implement blockchain.

7.1.6 Analysis of the Answers to The Rating Questions

Overall, the factors received ratings that were above neutral (3.9); all factors hence proved to be significant on some level. This is in accordance with the chosen theoretical framework of other implementation processes such as lean philosophy, agile methodology and ERP.

The factor that received the highest overall rating is "Managing and involving stakeholders (for instance customers and suppliers)". This is due to the distributive nature of blockchain technology; as collaboration over organizational boundaries is a necessity as well as one of the largest value creators for blockchain, this is not surprising. This factor proved to get the highest rating from the banking category as well, and the second highest from the experts. For banks, involving stakeholders is especially important as customer satisfaction is key for all activities and improving service is always the main focus. This is in accordance with the theoretical framework on implementation of innovative technology (Cooper et. al., 1990) and lean philosophy (Netland, 2016); involving stakeholders is of importance. However, this factor is likely more important for blockchain than for many other implementation processes due to its decentralized nature.

One of the factors that received the second highest overall rating is "Clear management support/ commitment/ involvement of the implementation"; this factor is important for most implementation processes, as seen from the literature review, but the distinction in the case of blockchain is that management support is needed for all actors in the blockchain. As the technology is so new as well as disruptive, clear management support is essential. One interviewee (see 6.2.1) specifically argues that management support and commitment are of much more importance than actual management involvement. The fact that this factor received one of the highest ratings is not surprising; from the literature review this proved
to be a CSF for all researched implementation processes. For lean and agile methodology, this is the most important CSF (Netland, 2016; Dikert, et al., 2016; Abdullah, et al., 2018).

The same rating was given to "Understanding of the organization in which the implementation is to take place (its strengths, needs etc)". This is most likely connected to the comments made about how the context plays a big role in the implementation process, as is argued in the theoretical framework on contingency theory (Fixsen et al., 2005). For banks, this factor got one of the lower ratings while for the experts, this is one of the two most important factors. This is likely due to the fact that experts view a blockchain implementation as a very big change for an organization and the context of the organization thus needs to be fully apprehended. For the banks that are actually attempting to implement blockchain, a noticeable difference has likely not yet been observed and has thus not affected their organizations much so far.

The fourth highest rating was given to the factor "A clear and communicated goal of what is hoped to be achieved by implementing the technology"; this is probably linked to the fact that a successful implementation of blockchain is dependent on there being an existing issue that blockchain can solve, and a goal that can be achieved by implementing it (Drescher, 2017). This factor got the biggest difference of rating between the banks and the experts, and the experts consistently rated this factor higher. A possible explanation for this is that banks believe that not all employees need to be fully aware of the implementation process; as the trade finance industry is so slow-moving (Chandna, et al., 2017), one does not wish to create unnecessary reluctance and resistance to change within the organization. Banks most likely have a more in depth understanding of the industry and the context as such than the experts do, resulting in a potential ignorance in the experts group.

The fifth highest rated factor was "Piloting the implementation process prior to full scale implementation as a way to gather insights". The interviewees had differences in opinions about this factor, which can be seen in that the ratings range from insignificant (see 6.2.1 and 6.2.4) to very important (see 6.2.2, 6.2.6, 6.2.7, 6.2.8, 6.2.11, and 6.2.12). There is not a distinct difference between banks and experts, but there is an overall difference in opinion. Some of the interviewees (e.g. 6.2.8 and 6.2.10) agree that this is a fairly important factor, as the technology is quite new and there is not much knowledge on it yet. As time goes by, knowledge will evolve and this factor will become less important (see 6.2.10). This is in accordance with theory on technology diffusion; the adoption of a technology is slower if there is not enough knowledge on the subject yet (Hall et. al., 2003). Also, much like for agile methodology, piloting is of importance as it creates the possibility to constantly improve the product before it is finalized (Laskowski, 2011; Dikert, et al., 2016). However, one interviewee (6.2.4) argues that piloting is unnecessary as piloting is often done separate from the actual organization and insights cannot actually be gathered as the implementation process depends on the context of the organization.

The sixth highest rating was given to "System quality, i.e. scalability, robustness, dependability, etc". Of course this is a fundamental necessity for the blockchain to work properly; especially in the trade finance industry, security is of great importance. Many interviewees (see 6.4.3, 6.4.5, and 6.4.11) argue that there are no issues with security in blockchain. Security is often mentioned as one of the main value creating features of the technology. Only one interviewee (see 6.4.12) argues that it is likely that hackers will find a way to get around even that high level of security, but of course one cannot know for sure.
Rather than security, the issues in blockchain lie in scalability (see 6.2.6, 6.2.9). This is partly supported by the theoretical framework on blockchain implementation (Karafiloski, et al., 2017); both scalability and security are identified as potential issues. However, it seems that only one of them proved to be true in the case of trade finance. One interviewee (see 6.2.12) states that even though financial services of course can not compromise on reliability and security, there are issues in emerging technologies that cause non-security related compromises to be made initially. According to theory on technology diffusion (Hall et. al., 2003), imperfections in new technology may make the diffusion of it more difficult. However, as the trade finance industry cannot compromise on security and would probably not have come as far with implementing blockchain technology if there were security issues, this is likely to be of lesser impact on its adoption rate.

There is quite a big difference in the opinions between banks and experts on this factor, where experts have been the more positive ones. Banks probably recognize that it is very difficult to have a fully functioning blockchain from the beginning, it has to develop to fit the organization. Also, within the group of banks, opinions differ quite much, from insignificant (see 6.2.6 and 6.2.12) to very important (see 6.2.4). This is likely due to the fact that different banks are involved in different blockchain consortia that are at different points in their processes and as such believe that system quality is of different importance. This is in accordance with the theory on agile methodology (Fowler et al., 2001), where it is viewed as easier to add something later on in a process that has proven to be too simple than it is to remove something from a process that has proven to be too complicated. By validating the features of a system early on, the risk of failing is reduced.

The seventh highest rated factor is "Cross-functional integration between different areas within the organization". There was at times confusion about this factor as most interviewees believed that cross-functional integration was of more importance between the different organizations in the blockchain rather than between different areas within each organization involved in the network. This can be seen in that the ratings of the factor vary and range from insignificant (see 6.2.10) to very important (see 6.2.1, 6.2.2, 6.2.5, 6.2.7).

The eighth highest rating was received by the factor "Well established motivation for the change throughout the organization, i.e. there is a sense that change is needed and necessary". All interviewees believed that this factor was fairly important but likely view this as part of the unnecessary collective approval of the implementation. There is not a distinct difference between the interviewees’ opinions depending on which group they belong to, rather it is the different individuals’ opinions that differ, ranging from insignificant to very important. Alike the implementation process of an ERP system (Sharma, 2004), the process is long and any transitional changes in the organization are not visible for several years; in order to assure that the goal is eventually met it is therefore essential that there is a well established belief and sense in that change is needed. However, one interviewee (see 6.2.12) argues that the need for motivation will differ depending on how much the change will come to affect the daily work of the employees. However, it is important to recognize that this factor is still important as it received an overall rating of 3.9. Having a well established motivation for change is important to avoid resistance to change (Fritzenschaft, 2014), which has the potential to be quite big in the trade finance industry due to it being so slow-moving (Long, 2017).
The ninth highest rated factor was "Performance measurement and data analysis, i.e. regular measurement of outcomes and results to generate reliable data that can be used for analyzing the implementation and assess if it is working well". Of course this is important in order to guarantee that the implementation brings value, but the performance measurement is fairly inherent in the actual technology (see 6.2.9) which is likely the reason for the factor to not be among the highest rated factors.

The tenth highest rating was given to "Employee training and education". The factor’s importance ranges from very insignificant (see 6.2.9) to very important (6.2.2, 6.2.3, and 6.2.5). This is likely due to the fact that some interviewees (e.g. 6.2.5, 6.2.7, and 6.2.12) think that it is unnecessary to educate all employees on the blockchain technology itself, while others see the need for education on how the employees’ work will change. However, as it received an overall rating of 3.8, it is still considered to be important. This is likely connected to training and education being an important factor for avoiding resistance to change (Lines, et al., 2015). This factor’s importance is in accordance with the theory on ERP (Sharma, 2004). Much like for an ERP project, a blockchain implementation stretches over a long period of time and the actual change occurs over time as the employees in the organization adapt to and learn how to best utilize the new system.

The eleventh highest rated factor is "Extensive project definition and planning". There is a very big difference in the opinions on this factor between the banks and the experts. Several interviewees (e.g. 6.2.4 and 6.2.5) agree on it being more important to work in an agile way. Banks rated this factor lower and a possible explanation is that they know from experience that the end result of projects rarely resemble an original project plan. Experts do not hold as much of a practical experience in conducting blockchain implementation projects, and hence might have a more naive viewpoint in that everything will work out as planned.

The twelfth highest rating was given to "Keeping the change communicable and transparent within the organization". This is one of the few factors that in general was rated higher by the banks than by the experts. This factor is somewhat in contrast to "A clear and communicated goal of what is hoped to be achieved by implementing the technology" that can be seen to be connected but was rated higher. A possible explanation is that banks do not see a need for everyone in the organization to have knowledge on the end goal. However, there is a distinction between having insights on the end goal and having insights on the change that is currently happening. While experts gave higher ratings to the latter factor, banks gave higher ratings to the first. A possible explanation may be that they had different perspectives when rating the factors. The experts recognize that a goal is necessary but do not specify that the goal should be communicated to everyone in the organization. Keeping the change transparent is of importance when trying to avoid resistance to change (DiFonzo, 1998), however it may also create resistance (see 6.2.5) if communicated too early.

The thirteenth highest, and thus the lowest, rated factor was "An in depth understanding for the technology that is to be implemented; what it is and how it works". Several interviewees (e.g. 6.2.5, 6.2.7, 6.2.12) state that there is no need for an in depth understanding of the technology behind blockchain throughout the organization. While some departments of the organization need to understand it deeply, others only need to understand the implications of the implementation on their work. Some interviewees (see 6.2.4 and 6.2.12)
draw a parallel to using the internet; one does not need to understand it in order to be able
to use it in a way that creates value. Even though an in depth understanding is not needed
for everyone in the organization, everyone must still be aware of the goal of the project as
they must all strive to collectively reach that goal. There is quite a big difference in opinion
between banks and experts; experts rated this factor higher than the banks. This could be
due to banks having a wider perspective than experts and are focusing more on the fact
that all parts of the organization do not need to understand the technology. This is in
opposition to the theoretical framework on lean where it was argued that knowledge about
lean should be spread throughout the organization to establish motivation for the change
and successfully implement lean (Wilson, 2010). This difference could be due to that lean
in a larger scale will affect the entirety of the organization, while blockchain affects certain
parts. Another reason may be that lean is easier to understand, while blockchain quickly
becomes too technical and difficult to fully grasp.

7.2 Value Creation

In order to answer sub-question 2, "What value does a blockchain create from a busi-
ness perspective?", the interviewees’ responses pertaining to this research question have
been analyzed below. A few areas of interest have been specifically mentioned by the
interviewees as key areas for value creation. The first one of these is that implementing
blockchain enables collaboration between organizations. Also mentioned is that the hype
itself surrounding blockchain creates value as it facilitates investments. Value creating
characteristics as well as the future potential of blockchain were also commonly discussed
and are therefore also analyzed below.

7.2.1 Enabling Collaboration

Almost all of the interviewees (see 6.4.1, 6.4.2, 6.4.3, 6.4.4, 6.4.7, 6.4.8, 6.4.9, 6.4.10, and
6.4.11) mentioned that there is value in that blockchain enables collaboration between
competitors that have previously not worked together. As blockchain is a distributed
database, this is inevitable; it is the very nature of the technology. Not many organizations
are used to working decentralized and there are challenges as well as value in this. This
is supported by the theoretical framework on blockchain implementation efforts (PwC,
2018), that an inability to bring the network together is a prominent factor in holding
the blockchain adoption back. To succeed with bringing the network together, there is
a need for a continuous discussion about what the degree of decentralization should be.
Many business models today are not fit for this new way of working, but by adjusting
to this new way of doing businesses, value can be created. Working over organizational
boarders requires better ways of communication and agreeing on the next step in projects
takes a longer time than for other technologies, but one interviewee (see 6.4.10) specifically
argues that the long-term benefits are greater than the short-time losses. The need for
management support is not limited to one organization, but all stakeholders involved in
a project need to be involved and committed (see 6.4.9 and 6.4.10). In accordance with
the theory on value creation (Dyer, et al., 2018); firms that work by engaging in repeating
alliances are expected to gather greater benefits that those who do not due to the increased
trust and level of coordination in relationships.

7.2.2 The Hype Itself Creates Value

As there is an increasing interest in blockchain technology, merely the use of the word
blockchain can facilitate investments and thus create value (see 6.4.1 and 6.4.4). Therefore,
many companies want to implement blockchain even though it may not be necessary. There is also a value in that blockchain can create discussion and foster communication and problem-solving as well as knowledge spreading, partly due to the code often being open-sourced.

7.2.3 Value Creating Characteristics

Many interviewees (see 6.4.2, 6.4.4, 6.4.7, 6.4.8, 6.4.9, and 6.4.11) agree that the true value in implementing blockchain lies in that it creates trust between the actors of the network as there is no room for interpretation in contracts. This is particularly important in trade finance, as explained in the theoretical framework on blockchain in trade finance (Long, 2017). In trade finance, the transaction is often between completely different parts of the world and therefore trust is a challenge. From the theoretical framework on blockchain implementation efforts (PwC, 2018), it was found that the issue of trust among users is in fact a prominent factor in holding the adoption of blockchain back. Many of the interviewees (see 6.4.1, 6.4.2, 6.4.6, and 6.4.7) also see an economical benefit from implementing blockchain. However, one interviewee (see 6.4.1) argues that value creation is dependent on how the goal is formulated. If the goal is to reach a bigger purpose than the technical implementation itself, for example learning, then of course one cannot fail and value will always be created. Other commonly mentioned value creating characteristics are that blockchain technology offers security (see 6.4.3 and 6.4.5, 6.4.10, 6.4.11, and 6.4.12), transparency (see 6.4.3 and 6.4.5), traceability (see 6.4.5), automation (see 6.4.2, 6.4.7, 6.4.9, and 6.4.10), and that it reduces the need for middlemen (see 6.4.8). There is also value in providing better services to the customer. Almost all of these value creating characteristics were expected and in accordance with the theoretical framework on benefits of blockchain technology (Drescher, 2017); reducing middlemen, creating automation, reducing costs, higher transparency, and higher efficiency are some advantages of implementing blockchain technology.

7.2.4 Future Potential

Some interviewees (e.g. 6.4.1 and 6.4.4) compare blockchain to the internet and state that the future potential of the technology could be as big as the internet, while others are more uncertain about the future potential of blockchain. One interviewee (6.4.4) believes that neither the technology nor society are mature enough yet for blockchain to realize its full potential. So far there has only been incremental changes in trade finance and no innovative changes (see 6.4.5). There is a lot of legacy in the industry (see 6.4.6 and 6.4.8) and this works against innovation as confirmed by the theoretical framework on trade finance (Chandna, et al., 2017). Another reason for slow adaption is explained through the theoretical framework on technology diffusion (Hall et. al., 2003); large firms tend to undertake innovative projects more often as they have more funding, but there are often multiple levels of bureaucracy in larger firms. All the banks interviewed in this study are fairly large. Today there are issues with scalability and speed that have to be solved. Some interviewees argue that the implementation of blockchain will render banks obsolete in the trade finance context, while others see it more as a positive challenge. One interviewee (see 6.4.12) particularly mentions that there is a very small chance that a Swedish bank will be the actor to successfully design a solution for blockchain in trade finance, and that this is a reason for not actively trying. By the theory on blockchain implementation (Du, et. al., 2018), perhaps the solution will rather be found by working together with startups in blockchain implementation because startups have more advanced technical and innovative
As of now, all banks that work with blockchain solutions within the trade finance context are working with permissioned networks. Some interviewees (e.g. 6.4.10) believe that a permissionless alternative is not an alternative, while one interviewee (6.4.4) sees a future potential in having a permissioned backend solution and a permissionless frontend solution. This is in accordance with the theory of (The World Bank, 2017); a permissioned network is often preferred by actors such as banks and governments as it makes the blockchain less transparent. However, the theory also states that a disadvantage of permissioned networks is that a high level of trust must be placed on the actors with permission to change entries (The World Bank, 2017); this disadvantage is supported by some of the interviewees’ concern with the issue on e.g. money laundering (see 6.2.4 and 6.4.12). Another concern with implementing permissionless networks is the issue of the high energy consumption that it requires (Adams, et al., 2017b). All blockchain projects that are currently active within trade finance are blockchain 2.0, smart contract based and dApp and DAI solutions have not yet been put in production.

7.3 Biases of Interviewees

As some of the banks interviewed currently take part in blockchain projects, they may feel a need to advertise their initiatives and thus give a more positive outlook on implementing blockchain than is actually the case. Banks that are currently involved in said blockchain projects are more positive towards the potential outcomes than those who are not. Banks provide services for their customers and therefore focus more on involving stakeholders and making sure that a possible implementation creates value from a customer perspective; some banks view blockchain as a solution in creating better service while others do not. Experts take a different perspective and while some of them are positive towards how blockchain may change the industry, some are more negative and focus more on identifying issues.

Interviewees with a more technical background focus more on technical issues while interviewees with a background in business focus more on the implications of blockchain and the organization. Not all experts have experience in the trade finance industry and therefore their opinions may not be as representative for this industry. As this was known beforehand, different questionnaires were constructed for the experts and the banks, where the questionnaire for the experts was less focused on the trade finance industry than the questionnaire designed for the banks. This may of course result in different views on the questions. Most interviewees are Swedish or from the Nordic countries. Only one is from outside the Nordic countries and may have a different perspective on the trade finance industry.
8 Conclusion

This section aims to summarize the results and analysis section as well as the study as a whole. This section also discusses the critical reflections on the findings in this thesis and implications in the theoretical and managerial areas as well as guidelines and suggestions for future research.

8.1 Summary of Findings

The research question; "What is required for a blockchain implementation to bring value to an organization?" is answered through answering the two sub-questions: "What factors are critical for a successful implementation of blockchain in an organization?" and "What value does a blockchain create from a business perspective?".

To the first question, one of the CSFs that stood out the most was that there had to be an existing issue or need for implementing blockchain technology in order for it to be successful. Another CSF was found to be the importance of collaboration, i.e. to understand that blockchain technology requires a new way of working over organizational boundaries. It is also of importance, especially in the trade finance context, to understand how regulatory aspects affect the solution. Furthermore, it is important to keep in mind how the context comes into play; every implementation will differ depending on the organizational culture and its characteristics. Another aspect that proved to be important to take into consideration when implementing blockchain technology is that the trade finance industry holds a lot of legacy and therefore can be quite resistant to change, especially a change of a largely disruptive character.

The most important factor among the CSFs that was identified through the theoretical framework of this thesis proved to be "Managing and involving stakeholders (for instance customers and suppliers)", due to the decentralized character of blockchain technology. One of the second most important factor was "Clear management support/ commitment/involvement of the implementation", due to the disruptive character and the fact that it is such a new technology. The same importance was given to "Understanding of the organization in which the implementation is to take place (its strengths, needs, etc)" due to that the context will greatly impact how the implementation process should be handled. While all factors received a fairly high rating in importance, these factors proved not to be as important in a successful implementation "Piloting the implementation process prior to full scale implementation as a way to gather insights", "System quality, i.e. scalability, robustness, dependability, etc", "Cross-functional integration between different areas within the organization", "Well established motivation for the change throughout the organization, i.e. there is a sense that change is needed and necessary", "Performance measurement and data analysis, i.e. regular measurement of outcomes and results to generate reliable data that can be used for analyzing the implementation and assess if it is working well", and "Employee training and education". The third least important factor proved to be "Extensive project definition and planning", which is likely due to a more agile way of working being more suitable for implementing blockchain. The second least important factor proved to be "Keeping the change communicable and transparent within the organization", as there is a distinction between having insights on the end goal and having insights on the change that is currently happening. The least important factor was "An in depth understanding for the technology that is to be implemented; what it is and how it works", where many interviewees agreed that one does need to fully understand the technology in order to be
able to use it.

The answer to the second question is primarily that blockchain creates value by enabling collaboration and trust. The very nature of blockchain technology requires the actors in the network to collaborate, and in the trade finance industry this is not something that is commonly done. Many identify a value in the problem-solving and more decentralized mindset that the technology will bring. Today, banks act as the trusted third party but if blockchain technology is implemented this role could be automated which will result in cost savings and better relations. Another interesting finding was that the mere use of the word blockchain could generate value as there is a hype surrounding it; both through enabling collaboration and investment. Other value creators mentioned were: security, transparency, automation, traceability, and decentralization. As it is such a new technology, the future of it is difficult to predict. While many are very positive and compare the disruptive power of it to the internet, some are less inclined to believe in the possibilities for blockchain technology, at least for the next few decades.

8.2 Discussion

Blockchain technology is still foremost a buzz word and not many actual implementation processes have been completed nor have the technology yet brought value to organizations. Only one of the interviewed banks in this thesis is a part of a blockchain consortia that is in production which may make many of the interviewees’ answers guesses rather than facts. What these interviewees believe are important success factors for implementing blockchain technology may hence not prove to be important factors when they actually start their implementation processes. Also, factors that were not found through the theoretical framework and the held interviews of this study, may prove to be critical for implementing the technology. However, the interviewees hold a lot of knowledge and are at the forefront of the blockchain field. This results in the answers to the research questions being as trustworthy as possible at this stage in the diffusion of blockchain technology.

As of now, the trade finance industry is currently working with blockchain 2.0: smart contracts. Smart contracts are automated and self-executing contracts which only carry out given that the pre-specified conditions are met. This increases speed, efficiency, and trust in that the contract is completed as should and there is hence no need for a third-party resolution. These factors were confirmed to be advantages of the technology by the interviewees.

The next stage is blockchain 3.0: decentralized applications (dApps), which is back-end code that runs on a decentralized peer-to-peer network connecting users and providers directly. In the case of a supply chain; each actor needs to have a node set up so that they can participate in the consensus process on the shared data. To enable all participants to store, retrieve, verify, and evaluate the data in the blockchain an interface is needed. This interface would be used by all participants to enter information and would therefore be the dApp. One issue in the trade finance industry, found during the interviews, is that all actors in the value chain may not see the benefit of using such an app; only the end users would really see the value. There may therefore be a need to find another solution in trade finance to work around this problem. Another potential finding may be that the implementation of dApps is essential for blockchain technology to reach its full potential in trade finance. If that is proved to be the case, as more banks put their work into production, dApps will naturally be used by more and more actors.
The stage after this is blockchain 4.0: decentralized artificial intelligence (DAI), which introduces autonomous decision-making and comes into existence thanks to the collective use of blockchain and AI. The role of blockchain 4.0 in the trade finance industry is much more difficult to imagine, both because AI does not exist yet and because it is difficult to imagine how such a slow-moving industry as trade finance will react to the technology. One idea is that DAI could solve the issue of having to check each actor’s trustworthiness before accepting them into the network as it produces a self-organizing value chain.

8.3 Blockchain and Sustainability

From the aspect of environmental sustainability, there are issues concerning the high energy consumption resulting from the high need of computing power. Permissionless networks require a higher energy consumption than permissioned networks which is a concern from a sustainability view in any future attempts of implementing permissionless networks within the trade finance context. As of now, what is used for validating new blocks is PoW, but PoW is very energy consuming and is therefore not optimal. In time, PoS will come into play and will be less energy consuming, so the future for blockchain looks brighter from an environmental sustainability perspective than the current state. From the aspect of social and economical sustainability, there is potential in that blockchain can enable more actors to use trade finance tools and thus enhance the economical performance of countries. However, most of the social sustainability in blockchain lie in other areas than trade finance, for example enabling economic stability in countries lacking proper governmental support.

8.4 Contribution

The contribution of this thesis can be divided into a theoretical and a practical contribution. The theoretical contribution is that this thesis has contributed to the field of blockchain technology as well as trade finance and implementation of innovative technologies.

As blockchain is still such a new technology, there is not much written yet on the topic and especially within the field of implementation. In accordance with the theoretical framework on technology diffusion, as time goes on more knowledge will be spread and implementation of the technology will happen more frequently. As more implementation efforts have been made, the literature on blockchain will expand accordingly.

As opposed to current literature on implementation, blockchain requires viewing the value chain as a network rather than as dual relationships. Blockchain requires a higher level of collaboration and involvement of stakeholders. This is due to the very nature of blockchain, it is a decentralized network.

Another finding that differs from current literature is that an implementation process is usually something that an organization has to go through in order to gain advantages from it, but in the case of blockchain, the actual implementation process can create value in itself. This is because the process in itself enables investment and collaboration. This is possible as blockchain is still a buzz word and many organizations are interested in exploring the technology.

The factors found through the literature review were confirmed to be CSFs for imple-
menting blockchain technology. Overall, the factors found were perceived to be important and no factor received a rating below neutral. However, less emphasis was put on understanding the technology and educating employees.

The practical contribution includes that it is necessary to collaborate over organizational boundaries. This is a new way of working within the trade finance industry and requires new business models. As in many other implementation processes, strong leadership is essential. However, for blockchain, it is important that the strong leadership is not only interorganizational but also intraorganizational.

The decentralized character of working with blockchain is cause for a longer implementation process. This is due to the fact that many organizations have to work together and agree on important decisions. These organizations may have different interests and opinions which may make it a time consuming process to reach consensus.

Another practical contribution is that of the character of the trade finance industry; it holds a strong legacy and has looked much the same for many decades. Many banks are not used to working decentralized and the industry is heavily characterized by being paper-based. This may indicate that there is a lot of resistance to change within the industry, especially towards disruptive changes such as blockchain. From an organizational view, it is important to keep this in mind and not force changes that may not be possible as of now.

8.5 Limitations and Future Research

As mentioned, blockchain is still in its infancy and has not been implemented in many cases yet. In this study, only one of the interviewed banks had an actual blockchain consortia in production, available to customers. This means that in many cases, the answers are mere guesses and not actually experiences. However, the authors of this thesis believe that, as experts and other very experienced people have been used as interviewees, these guesses are still qualified and hold interesting knowledge. As many banks are very interested and are currently exploring the possibilities of blockchain, it would therefore definitely be worth doing this study again in a few years when there are more blockchain consortia in production.

The experts interviewed for this thesis do not all hold experience within the trade finance industry, which could give biases in their answers. It would be interesting to perform this study again with more experts with specific knowledge in trade finance.

As previously stated, there is no community consensus on the definition of blockchain, everyone seems to have their own definition of what it is and these can vary greatly. This means that the interviewees may all have different definitions on what blockchain actually is and this may of course affect their answers.

Furthermore, more experts than banks were interviewed. Even though the difference is small, this may affect the results. The authors of this thesis would however like to stress that there are not many more banks that are big in the Nordics to interview. Also, only one person per bank was interviewed and thus only one perspective was obtained and used in this thesis. It would be of interest to interview several people and get a more diverse and unbiased result. An interesting way of improving the results of this study would also be to extend it towards banks operating in other countries than the Nordics, as there are many
banks globally that are involved in a blockchain consortium. However, these limitations were decided upon due to the time frame of this master’s thesis.

Yet another way to improve the result of this study would be to perform a second round of interviews with the interviewees, where all gathered success factors from the first round of interviews would be used as a basis for a new questionnaire, as a way to actually be able to rate each success factor, found both through the literature review and the first round of interviews, from most to least important in an implementation of blockchain technology.
References


Given, L. M., The SAGE encyclopedia of qualitative research methods, 1st edition (Sage, 2008).


Manski, S., ‘Building the blockchain world: Technological commonwealth or just more of the same?’, *Strategic Change* 26:5 (2017), 511–522.


White, G., ‘Future applications of blockchain in business and management: A delphi study’, 

Wilson, L., *How to implement lean manufacturing*, 1st edition (McGraw-Hill Professional, 
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Zhou, Z., Zhu H., ‘Analysis and outlook of applications of blockchain technology to equity 
A Feasibility Study Questionnaire

• What is your background in blockchain?

• What functions/sectors do you think are furthest along when it comes to implementing blockchain technology?

• What functions/sectors do you think have the most potential to benefit from implementing blockchain technology?

• What industry is most likely to implement blockchain technology first?

• Do you know any companies within those industries that have or are trying to implement blockchain?

• Which blockchain technology is most commonly implemented within the industries mentioned? (for instance, dApp, Smart contracts and cryptocurrency, and so on)

• What is the most common purpose companies are trying to reach as a result from implementing blockchain?

• What are the greatest challenges when it comes to implementing blockchain technology?

• Do you have any recommendations about people or companies we should talk further to?
B Feasibility Study Questionnaire in Swedish

- Vad är din bakgrund inom blockchain?
- Vilka funktioner/sektorer tror du har kommit längst när det kommer till att implementera blockchain?
- Vilka funktioner/sektorer tror du har mest potential att dra nytta av att implementera blockchain?
- Vilken industri tror du är mest trolig att implementera blockchain först?
- Känner du till några företag inom dessa industrier som har implementerat eller försöker implementera blockchain?
- Vilket är det vanligaste syftet som företag försöker uppnå genom att implementera blockchain?
- Vilka är de största utmaningarna med att implementera blockchain-teknologi?
- Har du några rekommendationer om människor/ företag som du tycker att vi bör prata med?
## C Feasibility Study Key Words

**Table 6:** The identified key words from the feasibility study interviews.

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Furthest Along</th>
<th>Value Creation</th>
<th>Future Potential</th>
<th>Challenges</th>
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<td>von Heijne, Nils</td>
<td>Banking, Bitcoind</td>
<td>Efficiency, Saving Money, Increased transparency, Increased safety</td>
<td>Middle hands, Need for Trust, Insurance Industry, Real Estate Industry, Charity Organizations, Streaming Services, Supply Chain Management, Production</td>
<td>Very new technology, Not much experience, Worry about technological shift, Few who know the technology, Takes a long time to implement</td>
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<td>Supply Chain Management, Gaming Industry, Payments, Walmart</td>
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<td>Interviewee 1</td>
<td>Cryptocurrencies, Transactionsbased Blockchain</td>
<td>Validation, Intermediaries, Sell the Hype, Not fall behind</td>
<td>Metrics, Insurance, Trade Finance, Energy industry, Not Supply Chain, Network-based information data storage</td>
<td>Why implement it?</td>
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<td>Finance, Trade Finance, Maersk, IBM</td>
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<tr>
<td>Lidman, Rufus</td>
<td>Cryptocurrencies, Finance sector, Clearing House, Central Security Deposits, Stock Exchange, Health Record and Transportation not as much, Currency Sector, Nasdaq, ASX (Australian Stock Exchange), DTC (central security depositories in the U.S., Lantmäteriet, Swedish Central Bank, IBM, Maersk, R3</td>
<td>Finance sector: save money and efficiency, Possible collaborations, Certificates, Receive Funding, Joint data base structure without central control</td>
<td>Finance Industry slow and regulated, Blockchain vs. regular cryptography?, Many actors - hard to build trust, Few actors - hard to scale, Misunderstanding of what blockchain is, Very technical, Decision-makers not enough knowledge</td>
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<tr>
<td>Wall, Erik</td>
<td>Fintech, Finance Industry, Monetary System, Education and certificates within education, Asia, SEB, DHL, Ripple</td>
<td>Reducing cost of administration, More efficient transactions, Government-owned companies more efficient</td>
<td>Where there are transactions, Transportation industry, Donations and charity, Insurances, Aid in globalization</td>
<td>Amateurs and scammers, Europe is lagging behind, Lack of strategic knowledge, Resistance to change, Change management</td>
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</table>
D Main Questionnaire - Experts

1. What is your background and experience in blockchain?

2. Why do you think blockchain would be chosen over others data bases? What does blockchain bring that other do not?

3. How does blockchain create value in trade finance?

4. Please rate each of the attributes in appendix [I] between 1-5 on their importance in making a blockchain implementation successful, where 5 is very important and 1 is very insignificant. Assume that developing the system/application is not part of the implementation. Also assume that an issue has been identified and that blockchain can be used to solve this.

5. What factors do you believe would differ in an implementation of blockchain compared to an implementation of other systems/processes?

6. What is a likely cause for a blockchain implementation to fail?

7. Are there any factors that are especially important for implementing blockchain in trade finance?

8. Are there any other comments you would like to add?
Main Questionnaire - Experts, in Swedish

1. Vad är din bakgrund och erfarenhet inom blockchain?

2. Varför tror du att blockchain väljs över andra databaser? Vad bidrar blockchain med som inte andra databaser bidrar med?

3. Vänligen gradera vardera attribut i appendix I mellan 1-5 baserat på hur viktiga de är för en lyckad implementation av blockchain, där 5 är väldigt viktig och 1 är väldigt oviktig. Antag att utvecklingen av systemet/applikationen inte är del av implementationen. Antag också att ett problem har identifierats och att blockchain kan användas för att lösa detta.

4. Vilka faktorer tror du skiljer sig i en implementation av blockchain jämfört med andra system/processer?

5. Hur skapar blockchain värde i trade finance?

6. Vad är en trolig anledning för att en blockchain implementation misslyckas?

7. Finns det några faktorer som är särskilt viktiga för implementering av blockchain inom trade finance?

8. Har du några övriga kommentarer?
F  Main Questionnaire - Banks

1. What is your background and experience in blockchain and trade finance?

2. In what way is your company incorporating and using blockchain?

3. What type of blockchain are you using? Permissioned and private or permissionless and public?

4. Why did your company choose blockchain? What does blockchain bring that others technologies do not?

5. How does blockchain create value for you?

6. Rate each of the attributes in appendix I between 1-5 on their importance in making a blockchain implementation successful, where 5 is a very important and 1 is very insignificant. Assume that developing the system/application is not part of the implementation. Also assume that an issue has been identified and that blockchain can be used to solve this.

7. What factors do you believe would differ in an implementation of blockchain compared to an implementation of other systems/processes?

8. What is a likely cause for a blockchain implementation to fail?

9. Are there any factors that are especially important for implementing blockchain in trade finance?

10. Are there any other comments you would like to add?
Main Questionnaire - Banks, in Swedish

1. Vad är din bakgrund och erfarenhet inom blockchain?
2. På vilket sätt använder sig ditt företag av blockchain?
3. Vilken typ av blockchain använder ni? Permissioned och privat eller permissionless och publik?
4. Varför valde ni blockchain? Vad bidrar blockchain med som inte andra databaser bidrar med?
5. På vilket sätt skapar blockchain värde för Er?
7. Vilka faktorer tror du skiljer sig i en implementation av blockchain jämfört med andra system/processer?
8. Vad är en trolig anledning för att en blockchain implementation misslyckas?
9. Finns det några faktorer som är särskilt viktiga för implementering av blockchain inom trade finance?
10. Har du några övriga kommentarer?
### H Main Questionnaire - Rating Questions

1. Clear management support/commitment/involvement of the implementation

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2. Well established motivation for the change throughout the organization, i.e. there is a sense that change is needed and necessary

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3. Understanding of the organization in which the implementation is to take place (its strengths, needs etc.)

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4. Piloting the implementation process prior to full scale implementation, as a way to gather insights

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5. Keeping the change communicable and transparent within the organization

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6. Employee training and education

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7. Extensive project definition and planning

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8. Managing and involving stakeholders (for instance customers and suppliers)

   Very Insignificant  Insignificant  Neutral  Important  Very Important

9. An in depth understanding for the technology that is to be implemented; what it is and how it works

   Very Insignificant  Insignificant  Neutral  Important  Very Important

10. A clear and communicated goal of what is hoped to be achieved by implementing the technology

   Very Insignificant  Insignificant  Neutral  Important  Very Important

11. Cross-functional integration between different areas within the organization

   Very Insignificant  Insignificant  Neutral  Important  Very Important

12. Performance measurement and data analysis, i.e. regular measurement of outcomes and results to generate reliable data that can be used for analyzing the implementation and assess if it is working well

   Very Insignificant  Insignificant  Neutral  Important  Very Important

13. System quality, i.e. scalability, robustness, dependability, etc.

   Very Insignificant  Insignificant  Neutral  Important  Very Important
I Main Questionnaire - Rating Questions, in Swedish

1. Tydligt stöd/engagemang/medverkan av management i implementationen

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2. Väl etablerad motivation för förändringen i organisationen, dvs. det finns en förståelse för att förändring är nödvändig

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3. Förståelse för organisationen som implementationen sker i (dess styrkor, behov etc.)

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4. Genomföra pilotprojekt av implementationprocessen innan fullskalig implementation sker, för att samla information och insikter

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5. Förändringen sker på ett transparent sätt och med tydlig kommunikation

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6. Utbildning och träning för medarbetare och anställda

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7. Omfattande projektdefinition och planering

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9. En djup förståelse för teknologin som skall implementeras; vad det är och hur den fungerar

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10. Ett tydligt och kommunicerbart mål av vad som önskas uppnås genom att implementera teknologin

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11. Tvärfunktionell integration mellan olika områden inom organisationer

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12. Prestationsbedömning och datanlys, alltså regelbunda mätningar av resultat för att kunna generera pålitlig data som kan användas för att analysera implementeringen och utvärdera ifall den fungerar bra

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13. Systemkvalitet, alltså skalbarhet, stabilitet, tillförlitlighet, etc.

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J Individual Answers to the Rating Questions

Below are the individual answers to the rating questions displayed. The vertical axis displays the rating given by each individual. A grey bar indicates that the interviewee belongs to the expert group while a light blue bar indicates that the interviewee belongs to the bank group.

Figure 18: Question 1: Clear management support/commitment/involvement of the implementation
Figure 19: Question 2: Well established motivation for the change throughout the organization, i.e. there is a sense that change is needed and necessary

Figure 20: Question 3: Understanding of the organization in which the implementation is to take place (its strengths, needs etc)
Figure 21: Question 4: Piloting the implementation process prior to full scale implementation, as a way to gather insights

Figure 22: Question 5: Keeping the change communicable and transparent within the organization
Figure 23: Question 6: Employee training and education

Figure 24: Question 7: Extensive project definition and planning
Figure 25: Question 8: Managing and involving stakeholders (for instance customers and suppliers)

Figure 26: Question 9: An in depth understanding for the technology that is to be implemented; what it is and how it works
Figure 27: Question 10: A clear and communicated goal of what is hoped to be achieved by implementing the technology

Figure 28: Question 11: Cross-functional integration between different areas within the organization
**Figure 29:** Question 12: performance measurement and data analysis, i.e. regular measurement of outcomes and results to generate reliable data that can be used for analyzing the implementation and assess if it is working well

**Figure 30:** Question 13: System quality, i.e. scalability, robustness, dependability, etc.