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The Adoption of Blockchain Technology in Norwegian Corporations

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Preface

This master thesis is part of our master's degree in Marketing and Brand Management at the Norwegian School of Economics.

This master thesis is one of a series of papers and reports published by the Center for Service Innovation (CSI). Centre for Service Innovation (CSI) is a coordinated effort by NHH to focus on the innovation challenges facing the service sector and involves 20 business and academic partners. It aims to increase the quality, efficiency and commercial success of service innovations and to enhance the innovation capabilities of its business and academic partners. CSI is funded through a significant eight-year grant from the Research Council of Norway and has recently obtained status as a Centre for Research-based Innovation (SFI).

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Executive Summary

Blockchain was launched as a social experiment by Satoshi Nakamoto in 2009, when the person or persons behind the pseudonym launched an online currency named Bitcoin. What started out as a decentralized alternative to traditional finance, has eventually turned into what some people believe to be a technological revolution. This may in time alter governments and businesses in the same way the Internet did when it was popularized.

However, there has been done little research on corporations and governments adoption of this new technology. The presented study aims to expand this research, and develop a theoretical model that could explain some of the adoption intentions among corporations and their employees. While being narrow in scope, the research may prove to be a suitable framework for broader future studies on the technology. The established theoretical framework of the Technology Adoption Model, with extensions from the Theory of Reasoned Action and Theory of Planned Behavior is the foundation for the research.

The data for this research was obtained through a survey (N=102), before the output was analyzed. The results show that *subjective norm* and *perceived usefulness* are important factors of the *intention* to use Blockchain technology among Norwegian corporations. All in all, this model explains 45.7 % of the variance in intention to adopt the technology.

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1. Introduction and Problem Statement

1.1 Introduction and Motivation

Since the introduction of the Internet in the early 1990's, the adoption of Internet technology has grown exponentially. Most new applications of technology are either utilizing or built on top of existing Internet technology. This ranges from the so-called Internet of Things, where an increasingly large number of everyday articles are connected to the Internet, to public infrastructure (Beck et al., 2016). This also applies to Blockchain technology.

With a world ever more connected to the Internet, systems for secure storage and transfer of data is increasingly important. Whereas traditional structures for storing and transferring data have been efficient for a long time, the increased exposure to cyber risks, demand alternative technological solutions. Blockchain is one of the most noticeable new technologies within the field in recent years. The cybersecurity market is approaching a total value of almost 100 billion U.S Dollars, and new technologies are being developed at a rapid pace. (Tapscott & Tapscott, 2016a). Blockchain is not just a supplement to existing cybersecurity solutions, but also a new way of storing and transferring data that increases security and transparency.

Blockchain started out as experiments of time-stamping digital documents, and creating a digital currency. Now it has turned into a buzzword within cybersecurity, finance and technology. Many private corporations are opening their eyes to the possibilities of utilizing Blockchain technology to replace existing systems, as well as creating new business possibilities (Tapscott & Tapscott, 2016a). This also applies to governments, who realize that storage and distribution of documents needs to be digitized in order to keep up with the technological evolution.

Whereas Blockchain originally gained the most traction in known technology hubs, such as Silicon Valley and Korea, the rest of the world is now opening their eyes to this new field (Antonopoulos, 2016). In Norway there is also increased attention towards the subject. Especially the field of financial technology is the recipient of increased attention in Norway, and

Blockchain is naturally connected to this.

In terms of relevant startups, Norway has entered the scene through a couple of well-connected developers who have launched successful Initial Coin Offerings (ICO), especially the cases of Iota and Hubii, raising significant funds in order to launch tokens in the cryptocurrency scene (Doctor, 2017). However, we want to focus on the adoption and usage of Blockchain as a technology, rather than cryptoeconomics in this thesis.

The increased traction and buzz for Blockchain technology worldwide, and in Norway, is a natural starting point for our thesis. However, the real value of a technology is first and foremost realized when it is being adopted at a broader level. Thus, our aim with this thesis is to discover what constitutes the drivers of Blockchain adoption in Norwegian corporations. The purpose of the thesis is to study which individual, social and organizational factors affect the adoption of Blockchain technology.

1.2 Research Questions

Drivers of technology adoption may, among others, be individual, social and organizational factors. This is in line with previous studies on technology adoption (Yousafzai et al., 2007) and will serve as a foundation for the differing research questions. The different categories of factors will be discussed further in the theory part of this thesis. By analyzing what factors drive the adoption of Blockchain technology, one will be able to see whether it is the individual factors, the social factors or the organizational factors that play the key role in adoption of Blockchain technology.

We have decided on the following research questions for further studies in this thesis.

RQ_1: Which individual factors affect Norwegian corporations' intention to use Blockchain technology?

RQ_2: Which social factors influence Norwegian corporations' intention to use Blockchain Technology?

RQ_3: Which organizational factors influence Norwegian corporations' intention to use Blockchain Technology?

This study is limited to measuring adoption in Norwegian corporations. In terms of industries, the survey is mainly limited to the Banking/Finance, Consulting, Insurance, Industry/Retail and IT/Technology sector. This reduces the generalizability of the analysis; however, it may also prove to be a good basis for future studies.

1.3 Contribution

In this chapter, we will look into the theoretical and managerial contribution this thesis could present, as well as presenting the outline of the thesis.

1.3.1 Theoretical contribution

Given the recent birth of Blockchain technology, most of the research related to the subject is focused on the technology itself, rather than adoption. However, as the technology is gaining traction, there has been an increasing number of research done by corporations on the application of the technology, as well as articles in journals. For instance, Harvard Business Review have published a number of articles merely explaining the implications of the phenomenon. One example of this is Iansiti & Lakhani's (2017) article explaining the broader definition of Blockchain. These articles are supplemented by reports from consulting firms as well as financial institutions, for instance consulting companies such as McKinsey & Company (2016b) are using their research labs to publish articles in the field. Most of these publications discuss the possible positive impacts of the technology, rather than focusing on positive and negative factors of adoption.

However, the research on adoption of technology as an academic field is quite extensive. Ranging from publications in the early 1990's of barriers to adoption of technology, with an emphasis on societal development (Parente & Prescott, 1994), to analysis and development of the well-recognized Technology Acceptance Model (Davis, 1989). The Technology Acceptance model is a widely credited and referenced model, and have for instance been applied to adoption of both email and internet technology. Blockchain on the other hand is a technology that is relatively immature both in terms of adoption, and research that has been done on the topic. This thesis is contributing to the theoretical field by combining well-known and recognized models of technology adoption, and applying it to a new technology. By utilizing existing findings in the technology adoption field, one could compare these with the adoption of Blockchain technology.

Furthermore, our thesis is looking to measure factors of the adoption of Blockchain technology, more specifically individual, social and organizational factors. This approach, compared to more extensive publications within the field, is quite narrow. Even though the possible external applications of our research are limited, the approach with using individual, social and organizational factors may be used in future studies as a basis for hypotheses and research.

Existing research on the adoption of Blockchain technology, such as the "Braving Bitcoin"-article by Folkinshteyn & Lennon (2016), utilized the TAM-model, and expanded it to include factors for measuring electronic commerce. We are looking to expand the TAM-model with external factors consisting of organizational and social factors. In a theoretical perspective, this approach has not yet been used to measure the adoption of Blockchain as a technology, and will thus be a new way of approaching this topic. The theoretical contribution of this thesis is for the most part a contextual one, meaning that we are testing combinations of established theory on a new technology.

1.3.2 Managerial contribution

Storing and sharing data today, revolve around models where databases serve as a central connector for interaction. Blockchain technology is a new way of organizing and transferring data, by decentralizing it. The implications are many, but some of the most obvious are increased data security as well as controlled access to relevant data (Tapscott & Tapscott, 2016a). Blockchain technology allows for a new approach to store and transfe data, essentially meaning that corporations in the future may have a different structure both in data storage, and how their support functions, such as IT-support and cybersecurity units are organized.

The implications of Blockchain technology in cybersecurity are many. From countries storing their health records on distributed ledgers, to making traditional passwords obsolete. The key takeaway is that storing data on distributed ledgers creates multiple points of attack, rather than a central database that is one single point of weakness (Barzilay, 2017). In addition, the transfer of data is traceable and immutable (Tapscott & Tapscott, 2016a). As healthcare institutions look to store their data on distributed ledgers, other entities may consider doing it as well, further increasing adoption (IBM Institute for Business Value, 2016). What started out as an idea of time-stamping digital documents, may in time change how individuals, corporations and governments store and control access to data (Stornetta & Haber, 1991).

The development and use of Blockchain technology may in time constitute the biggest change to this date in how one securely stores and share data. Thus, resulting in significant implications for corporations looking to meet the demands of the future. For instance, adopting a new way of storing your data requires a different skillset than what is already present in many companies, in terms of technological expertise. Furthermore, large consulting companies may face a shifting demand for technological solutions, where one used to implement efficient database solutions, and now wish for a transition to a distributed ledger.

Blockchain Technology has been coined "The Internet 2.0", or "The new Web", implying that it is the face of a technological revolution (Lakhani & Iansiti, 2017). Even if Blockchain technology does not turn out to be "the next Internet", the technological implications are noteworthy, by completely removing the need for centralized third-parties and trust in transactions (Bjørkeng, 2017). By applying programmable smart contracts, the implications for corporations working with funds in escrow, settlement accounts and contract law are significant (Tapscott & Tapscott, 2016a). This could allow for less subjective disputes in trades and contractual settlement, potentially increasing the efficiency of operations for companies utilizing the technology.

All in all, the results in this paper may give an indication as to whether Norwegian corporations have adopted, or intend to adopt Blockchain technology, and if so, what the most important drivers for adoption are. For Norwegian corporations it may be of importance to look at what factors affect the adoption of a new and disruptive technology, and as a result take action. The data may yield results concerning what types of support structures are important for facilitating adoption of Blockchain technology. Companies can act in accordance with this information and gain a head start in the adoption of a new technology. As the technology moves into a phase where it not only seeks to replace existing technologies, but also create new areas of business, it is interesting for corporations to look at what factors stimulate adoption of the technology, as this in time may yield a competitive advantage. Furthermore, as experience with a technology increases, it is reasonable to assume that the factors affecting adoption will change, and thus it is of importance to managers to see what they can do to increase adoption.

1.4 Outline

Chapter 2 is a context chapter, defining what Blockchain is, and the different implications of the technology. As Blockchain is a relatively new technology, it also includes a figure, describing how data is stored and how entities communicate with each other on a Blockchain based network. Furthermore, the chapter describes the abilities of a Blockchain network, before discussing use-cases of the technology.

Chapter 3 reviews the most important theoretical literature, used in the thesis, as well as presenting the models for measuring adoption of technology. This chapter is the basis for the later developed research model.

Chapter 4 explains how the model is built from the theory presented in chapter 3, while also providing definitions and details regarding the factors we are measuring. The chapter finishes by stating the hypotheses we are exploring in the thesis.

Chapter 5 illustrates the methodological framework we used to conduct the empirical study. We also discuss the sample from which we pick the respondents, as well as statistical measures that will be part of the analysis. Towards the end of the chapter we discuss reliability, validity and the ethical considerations taken into account during our research.

Chapter 6 explains the process of analyzing collected data. It also presents the demographics of our sample, as well as a statistical analysis of the items, measurement and factors.

Chapter 7 presents the results from our analysis, as well as the significance of the measured factors. The end results is presented together with a conceptual model and the hypotheses.

Chapter 8 and 9 discusses the conclusions from our research, as well as the theoretical and managerial implications of the study. Finally, the limitations of the study is presented, and future research is proposed.

2. About the Blockchain

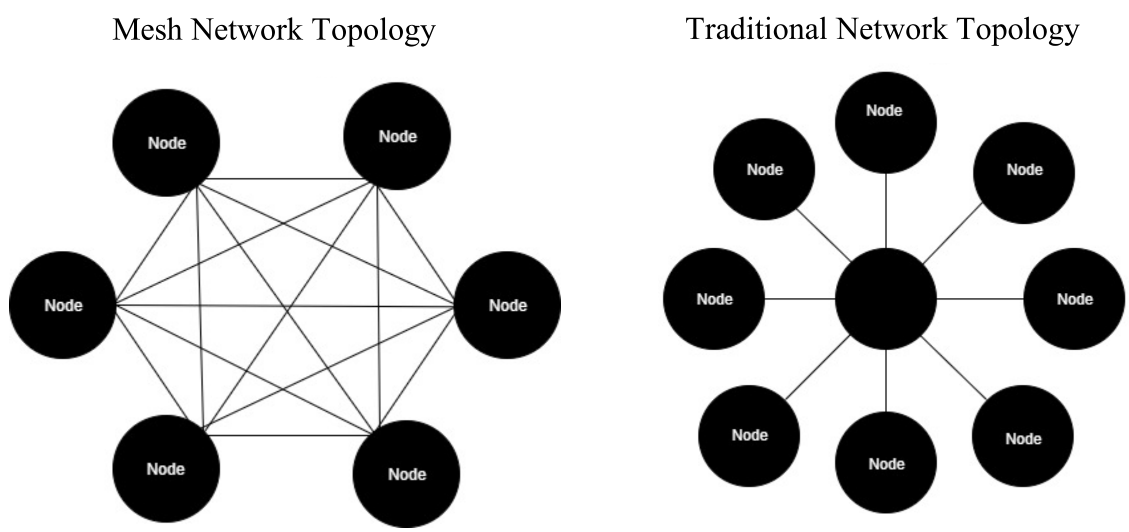
The idea of a Blockchain was first presented in the Journal of Cryptology, by cryptographers Stuart Haber and W. Scott Stornetta, in a paper titled "How to time stamp a Digital Document" from 1991 (Stornetta & Haber, 1991). The problem with time stamping a digital document surfaced when the authors discovered that digital files can be altered, and thus the time stamps of the documents. They point out a possible solution to the problem as cryptographic and algorithmic trust, between parties, rather trust in a third party or each other.

Being in the early days of the Internet, Haber and Stornetta did not reach the masses with their idea of cryptographic trust between parties. However, the concept was revived in 2008, when Satoshi Nakamoto released a whitepaper on a digital peer-to-peer system for digital cash, named Bitcoin (Nakamoto, 2008). With internet technology being more mature than in 1991, Satoshi proposed a system based on a distributed ledger, where all transactions are verified by network nodes (Antonopoulos, 2016).

Blockchain is built on top of the traditional World Wide Web, and is thus dependent on underlying Internet technology. Blockchain is by many called "the trust protocol", and revolves around achieving trust in the digital age. In business, trust, is one parts expectation that the other party will act in accordance with the four principles of integrity; honesty, consideration, accountability and transparency (Tapscott & Tapscott, 2016a). If a system removes the need to believe in the counterparty's honesty, consideration, accountability and transparency, one has achieved trustless transactions. Blockchain technology aims to remove these factors of trust, and instead base them on algorithmic and mathematical conditions. The structure of the Blockchain is described below, and implicitly describes how these factors of integrity are solved through Blockchain technology.

2.1 How Does the Blockchain Work?

Figure 1: Network Topology



The above figure is a simplified view of how peers connect on a traditional network and a mesh network. The figure is self-developed, although based on traditional network topologies from Bradley (2001). A Blockchain-based network resembles a mesh network in structure. The most significant difference is that in a traditional network (right), all nodes are connected to each other via a centralized master node, or a database. However, in the mesh typology, each node is connected to each other. The network topology is a tool used to visualize the structure of a database, and how the different nodes or computers are interconnected. It is useful for showing the difference between a traditional network and a mesh or a Blockchain structure (Bradley, 2001).

2.1.1 Distributed database

A Blockchain is a distributed database where each participant has access to the entire database and its complete history. An essential function is that no single party controls the data or the information stored on the Blockchain. Further, there is no need for a third party or intermediaries to verify transactions between peers (Lakhani & Iansiti, 2017). This is illustrated in the left figure above, where the database is distributed between each node simultaneously, effectively meaning that there is a need for consensus between a majority of the nodes for validating the contents of the database. As mentioned, the data stored on the Blockchain is available to everyone participating in the network, however, the actual contents of data, is only available to those holding the hash-signature or private key related to that data (Nakamoto, 2008).

2.1.2 Peer-to-peer transmission

Within a Blockchain, the communication between peers is done directly, and later verified by the ledger, rather than through intermediaries, which is standard in IP/TCP-protocols. The information from a node is forwarded and stored by all other nodes within the Blockchain (Lakhani & Iansiti, 2017). The Blockchain enables automatization between individual parties, which effectively removes the intermediary. As long as the public ledger works as it is supposed to, there will be no need for third parties when individuals want to exchange data and content. The result is peer-to-peer automated transactions, governed only by computer code (Tapscott & Tapscott, 2016a). Peer-to-peer transactions and communication over the Blockchain is also the basis for completely new business models. Some of these business models aim to automate traditional business of transactional nature, for instance lending and insurance (Shrier et al., 2016).

2.1.3 Transparency with pseudonymity

Blockchains are maintained on a ledger, which may be either public or private. However, the ledger is always public to all participants on the ledger. Effectively meaning, that all transactions are visible to every participant in the system. Rather than identification by name, each node on the ledger is represented by a unique alphanumeric address, giving each node the choice of anonymity (Lakhani & Iansiti, 2017). Blockchain technology was developed and commercialized in 2008 when the public trust towards financial institutions were at an all-time-low (David, 2015). Public Blockchains are completely transparent in transactions, meaning that one can easily see whether it is trustworthy or not, as opposed to traditional banks and financial institutions. The transparency in this case allows for pseudonymity, while also increasing the trust between parties (Tapscott & Tapscott, 2016a).

Pseudonymity is secured by only identifying actors within the network through a double hash signature-scheme. In essence, this means that each actor in the network has a public and a private key. The public key is cryptographically derived from the private key, but the operation is hard to reverse, meaning that one can share the public key, while keeping the private key safe. This provides pseudonymity to the participant, as only the public key is used for signing transactions, at the same time, the network has complete transparency of transactions signed by the public keys (Pilcington, 2015; Popper, 2015; Tapscott & Tapscott, 2016a). The encryption of private addresses in a Blockchain is traditionally done by using a private key as input into a Secure Hashing-256 Algorithm (SHA-256). The SHA-256 algorithm is known for scrambling input data into 64-character output, essentially making it impossible to reverse-engineer, unless using wast amounts of computing power to brute-force it (Hilbert & Handschuh, 2003; Antonopoulos, 2016).

2.1.4 Irreversibility of records

Once transactions are entered in the network, and the nodes are synchronized to the Blockchain, the records are impossible to alter unless you control the majority of the network nodes (Antonopoulos, 2016). The reason for this is that each node in the Blockchain confirms the transaction, while also linking it to all prior transactions within the chain. This is done through algorithmic and cryptographic proof (Lakhani & Iansiti, 2017). Similar to traditional double-entry bookkeeping, the Blockchain ledger signs off transactions by verifying them. As with double-entry bookkeeping, you would have to change all prior transactions and numbers within the account to reverse a record. The same applies to the public ledger, where every previous transaction would have to be altered and verified by all the nodes in the network for the transactions to be reversible, essentially resulting in an almost immutable ledger (Tapscott & Tapscott, 2016a).

Given that a public ledger is supported by unrelated nodes, all motivated by individual incentives, reversing records would have to meet the incentives of the majority of nodes in the network. If one disagrees with the majority of nodes in a network, one is free to not participate in the network or try to establish a majority. By having irreversibility of records and transactions, one removes an important factor constituting trust, namely accountability (Tapscott & Tapscott, 2016a).

2.1.5 Computational logic

Being based on algorithmic and computational trust, the nature of the ledger allows users to set rules that automatically trigger future transactions. In essence, this means that one can establish self-fulfilling contracts, also known as “smart contracts”, through a Blockchain (Lakhani & Iansiti, 2017). The smart contract both presents the contents of a contract, as well as executing the contract when conditions are met. When computational logic is used as a basis for self-governing contracts, the use cases are many. Proposed use cases are self-fulfilling financial escrow accounts, prediction markets and distribution of royalties, among others. The basic explanation is that, as long as the contractual conditions are objective and easily identifiable, they can be programmed into a functioning smart contract, all based on computational logic (Idelberger et al., 2016).

Mathematics and algorithms base solutions on an undisputable set of conditions, that are objective rather than subjective. Blockchains are based solely on functioning algorithms and mathematics, which essentially removes the need for third-party trust, and trust between interacting parties. (Beck et al., 2016)

2.2 Use Cases

The most recognized use case for Blockchain technology to this point in time, is cryptocurrencies, with the most known currency being Bitcoin. Bitcoin is the first public Blockchain, and in many cases the first real test of the technology in a large scale. However, there are numerous use cases for Blockchain technology, ranging from cryptocurrencies to the storage and transfer of public documents. Some researchers claim that Blockchain is a technology with similarities to the Internet, in essence meaning that it will eventually have a place in most modern industries (Tapscott & Tapscott, 2016b). Tapscott & Tapscott (2016a) propose a wide variety of use cases, including secure voting systems, distribution of music royalties and proof of ownership of documents and assets. This is also in line with researchers from Massachusetts Institute of Technology, who believe that both proof of ownership and insurance cases are suited for Blockchain technology (Shrier et al., 2016).

2.2.1 Cryptocurrencies and financial technology

Cryptocurrencies started out as an idea of a decentralized currency, not tied to central banks or governments, and has since developed to a whole ecosystem of coins with different functions. The most significant cryptocurrency is Bitcoin, with a total market capitalization, at the time of writing, of over 68 billion U.S Dollars (Coinmarketcap, 2017).

Bitcoin first surfaced through the pseudonym Satoshi Nakamoto and his whitepaper which surfaced on a mailing-list in 2009, proposing a cryptographic solution for a digital currency. The whitepaper proposed a currency based on trust in a public ledger, rather than third parties such as governments or central banks (Nakamoto, 2008). Over the recent years, many new cryptocurrencies have surfaced, many of them with different underlying value propositions. One example is Ethereum, which is an alternative protocol, mainly created for building decentralized applications on top of it. It differs from Bitcoin in the sense that it is not mainly thought of as digital cash, but rather as a framework for future applications (Butherin, 2014). The Ethereum Blockchain is a chain with features ranging beyond those of digital currencies, which is emphasized by the development of smart contracts.

Even though cryptocurrencies are what most people seem to think of when Blockchain is being mentioned, the use cases of the technology extend beyond that. Interbank transactions are the most common way to transfer currencies between countries and banks. This market could be automatized and made more effective by applying Blockchain technology, which has also been discussed by the United States Federal Reserve, in a report regarding Blockchain in financial settlements (Mills et al., 2016). Client onboarding services in banks is also a field currently being tested for Blockchain technology by consulting firm Deloitte (2017). The research aims to discover if Blockchain technology makes it easier for banks to fulfill the requirements for the Know Your Customer-rules in the onboarding process (Underwood, 2016).

2.2.2 Private Blockchains

A private Blockchain differs from a public Blockchain in restrictions regarding who is allowed to participate in the network. Whereas Bitcoin utilize a public ledger, where everyone may participate, corporations may want to set up a private network, where participation is by permission only. Private Blockchains have restrictions to both read- and write-access, this means that the owner of the private Blockchain may select who is allowed to view the transactions on the chain, as well as who may transact with it. This allows for businesses to open for transparency, while still securing that they are the only ones who transacts within the private Blockchain. (Pilcington, 2015).

Private corporations may use Blockchains to maintain control over their supply chain, and in the fight against counterfeit products (Jayachandran, 2017). For instance, a watch manufacturer, who suffers from illegal counterfeiting, may want to build their supply chain on a Blockchain. By doing this, they will be able to gain full overview of the ownership of a watch at any given time during the production, shipping and sale, meaning that proving authenticity is easier towards the end consumer (Hanlon, 2017).

Private corporations have in the later years become increasingly aware of the importance of cybersecurity, and the awareness is growing at a rapid pace. Experts estimates the market for cybersecurity-services to double from year 2015 to 2020 (Morgan, 2015). Blockchain is naturally linked to cybersecurity, as it reduces the possibility for a single point of attack. Due to the nature of the Blockchain, data stored on it is cryptographically secured by different nodes in the network, making it more efficient at stopping malicious attacks, than traditional firewalls (Kshetri, 2017).

2.2.3 Use of Blockchains in the public sector

While the use of Blockchain within the public sector is not subjected to broad adoption as of yet, many believe that this will be where the application of the technology will be most significant. The health care sector is viewed by many as a sector that may benefit greatly from Blockchain adoption. A survey conducted by the IBM Institute for Business Value in 2016, concluded that almost 16 % of the surveyed healthcare executives expected to have a commercial Blockchain in place by the end of 2017 (IBM Institute for Business Value, 2016).

The study shows that the executives of both healthcare providers and payers expect reduced friction to be the key selling point of adopting Blockchain within the sector. An example from the article suggests that the medical data of a patient could be tied to a Blockchain, effectively giving every instance that examines the patient, or prescribes as drug, a full view of the relevant medical history. This reduces the friction of inaccessible and imperfect information, which are viewed as crucial to a more streamlined health care sector (IBM Institute for Business Value, 2016).

Blockchain technology is also believed by some to provide an extra layer of state-side governance and democratic security. By issuing democratic votes on a Blockchain, elections are less likely to be tampered with, and as a result a possibility of a more efficient direct democracy. By digitizing voting systems, and in time enabling a Blockchain-based system, the reliability and convenience of voting in democracies may increase (Foroglou & Tsilidou, 2015). This can be applied to voting as a tool in democratic societies, and also within organizations and internally in government institutions, i.e. a parliament. An example of this is an organization in Australia called the Neutral Voting Bloc, which aims to revolutionize democracy by allowing voters to voice their opinions on the Blockchain network (Tapscott & Tapscott, 2016a).

The Republic of Estonia is one of the pioneers when it comes to using Blockchain technology in the public sector. In a program called e-Estonia, the country is already issuing electronic identity cards to more than 90 percent of the country's population. This has resulted in a technological revolution for the inhabitants of the country, where over 95 percent of the population now submit their tax statements electronically and conduct more than 98 percent of their banking transactions online. All of this is done either through cryptographic security or Blockchain technology, ultimately showing that the use cases in the public sectors are many (Tapscott & Tapscott, 2016a).

2.2.4 Use cases in insurance

As in most other use cases for Blockchain technology, customer engagement and storage of personal data on a distributed ledger is a natural starting point. By storing the data on a distributed ledger, one makes sure that personal data is owned by the customers themselves, rather than the insurance company. This might make the onboarding of new customers easier, seeing as the regulatory framework is easier to navigate both for the consumer and the insurance company (McKinsey&Company, 2016a).

Functioning, self-fulfilling smart-contracts, as proposed by Vitalik Butherin in the Ethereum whitepaper (2014), could also provide a basis for automatic handling of claims towards the insurance company. Contracts governed by code are less prone to subjective treatment, which in time may create a more efficient and transparent system for handling insurance claims (Butherin, 2014; McKinsey&Company, 2016a). In effect, insurance contracts governed by code may cause less disputes regarding insurance claims. Furthermore, there is a potential to reduce costs due to the reduction in manual labor needed to handle claims and develop insurance contracts.

Peer-to-peer insurance is also a possible use case in the insurance sphere. An example is drivers of sharing-economy corporations such as Uber and Lyft, who could pool their money and utilize smart contracts to insure each other. Some also argue that traditional insurance companies mainly do tasks that could be done peer-to-peer on the Blockchain in the future, and thus conclude that Blockchain could eventually remove the need for these companies (Shrier et al., 2016).

2.3 Current Adoption of Blockchain Technology

This thesis aims to discover how Blockchain-technology is adopted by Norwegian corporations. However, looking at existing adoption of the technology at a global scale is relevant to put the thesis in the right context. Blockchain technology is still considered to be in its early stages, however, corporate executives may want to be early adopters of new technology to gain potential competitive advantages. A study by IBM's Institute for Business Value shows that one third of C-level executives are either considering, or already using the technology (IBM Institute for Business Value, 2017; Cachin, 2016). Examples of corporate adoption is the open source HyperLedger project, instigated by The Linux Foundation, and backed by significant corporations in finance and technology. The ledger aims to advance cross-industry Blockchain-technology, and create an open-source standard for distributed ledger projects. (Cachin, 2016)

Furthermore, there are examples of public Blockchain adoption. For instance, the city of Zug in Switzerland, has established itself as "Crypto Valley". The city is already issuing passports connected to a Blockchain, and has altered the financial regulatory framework towards Blockchain companies, in order to attract talent and business in the sphere (Vitaris, 2017). As mentioned, the Republic of Estonia is also a pioneer when it comes to Blockchain adoption. Public records, including patient journals, are stored on the country's private Blockchain (Tapscott & Tapscott, 2016a). Most of the current adoption of Blockchain is done by newly formed companies who base their business models solely on solving a problem with Blockchain technology. However, it is likely that we will see an increased number of hybrid business models, that utilize the Blockchain on top of their existing operations in the future (Crosby et al., 2016).

Lakhini and Iansiti (2017) propose a four-by-four matrix with two dimensions to explain how the use cases for new foundational technologies evolve. The four phases are divided into single-use, localization, substitution and transformation, based on the novelty and the complexity of the application. An application with relatively low novelty and complexity, is typically single-use cases, like payments. The applications in this phase are typically solutions that aim to replace an existing service, such as Bitcoin is for payments. The second phase, known as localization, focuses on applications that are high in novelty, but demands a lower userbase to function. An example of this is a private online ledger. The third phase is substitution where the novelty is low, but the complexity is higher, this is for instance a workaround to existing problems, for instance third-party services which makes cryptocurrencies available as payments. (Lakhani & Iansiti, 2017).

The fourth phase of technological evolution is where one utilize the new technology to transform the nature of systems that are already in place. Transformation of existing systems usually occur after a technology has been proven and tested through the previous phases. For Blockchain technology, this could be self-governing smart contracts, changing the nature of how humans transact with each other. Considering how traditional companies are based on written and oral contracts, this could change the very nature of how a firm is operating. (Lakhani & Iansiti, 2017). When we aim to measure Blockchain adoption, we want to look at how corporations are looking to replace or add to their existing operations by implementing this technology. Thus, we are aiming at the transformational phase of technological evolution.

3. Theory

As this thesis seek to research how Blockchain-technology is adopted by Norwegian corporations, we will in this chapter look into different theoretical frameworks related to adoption of innovations and technology.

Rogers (1983) defines innovation adoption as a consumer's decisions to make full use of an innovation. Fishbein & Ajzen (1975) explains behavioral intention as *"a person's subjective probability that he will perform some behavior"* (1975;288) and furthermore actual behaviour as *"a person's behavior is determined by his intentions to perform that behavior"* (1975;335). These definitions provide a theoretical substance for further application of theory.

The first part will look into the adoption models *Theory of Reasoned Action* (TRA) (Fishbein & Ajzen, 1975) and the *Theory of Planned Behavior* (TPB) (Ajzen, 1991). The TRA and TPB have over time been used to predict a wide range of behaviors, while also considering consumer decision-making processes (Armitage & Conner, 2001;Venkatesh et al., 2003). In addition, these models provide the theoretical fundament for changing behavior, and among others the private adoption of innovations.

These two theoretical frameworks constitute the fundament and support for the *Technology Acceptance Model* (TAM) (Davis, 1989), which is the theoretical basis for this thesis. TAM researches adoption of technological innovations, and is therefore highly suitable as a theoretical backbone for this thesis (Davis, 1989).

Since we seek to research this adoption on an individual, social and organizational level, we will also look into other factors for adoption in this chapter. Furthermore, we will present the TRA, the TPB and the TAM, and discuss their application towards our suggested research model on Blockchain Technology adoption, which will be presented in chapter 4 of this thesis.

3.1 Theory of Reasoned Action

The Theory of Reasoned Action (Fishbein & Ajzen, 1975) seeks to explain the deciding factors in individual intention towards technology usage and adoption. The model utilizes the individual behavioral attitude, subjective norm, behavior intention and actual behavior to explain technology adoption.

Martin Fishbein and Icek Ajzen (1975) argues that it is an individual's *behavioral attitude* and *subjective norm* that affects the individual's intention of utilizing a new technology. Furthermore, *behavior intention* explains the individual's reason behind utilizing this technology, and measures *actual behavior*. Fishbein & Ajzen (1975) further argues; if the intention behind usage is strong enough, this will over time result in actual usage.

Attitude is defined as *"a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object"* (Fishbein & Ajzen, 1975;6). In other words, an attitude is the current learned opinion towards a technology in this context. On the contrary, an attitude is not synonymous with behavior intention, as subjective norm also affects this decision. Individual attitude is affected by *behavioral beliefs.* These beliefs are by Fishbein & Ajzen (1975;131) referred to as *"a person's subjective probability judgments concerning some discriminable aspect of his world".* From Fishbein & Ajzens (1975) it is stated that attitude toward an object is related to beliefs about the object, this follows Fishbein's (1963) argumentation regarding the multiattribute model.

Subjective Norm is defined by Fishbein & Ajzen (1975) as *"other beliefs relevant for a behavioral intention are beliefs of a normative nature, i.e., beliefs that certain referents think the person should or should not perform the behavior in question. The person may or may not be motivated to comply with any given referent. The normative beliefs and motivation to comply lead to normative pressures. The totality of these pressures may be termed "subjective norm"* (Fishbein & Ajzen, 1975;16). Subjective norm revolves around the social consequences of behavior, and how the individual deals with external influences on behavior. Finally, the model states that intention leads to a specific and actual behavior.

3.2 Theory of Planned Behavior

The Theory of Planned Behavior is an extension of the TRA-model (Fishbein & Ajzen, 1975) introduced by Ajzen in 1991 as measure to modernize the original model (Ajzen, 1991). The reason for this was that the TRA-model inadequately predicted how an individual act, when he or she is not in complete control over their own actions. As a consequence, Ajzen included *perceived behavioral control* which encompasses internal and external constraints on behavior in the TPB-model. Ajzen (1991;183) defines *perceived behavioral control* as "*people's perceptions of the ease or difficulty of performing the behavior of interest".* This is closely compatible with Bandura's (Bandura 1977; Bandura 1982) concept of perceived *self-efficacy* which *"is concerned with judgments of how well one can execute courses of action required to deal with prospective situations"* (Bandura, 1982;122).

The model states that when a person have complete control over individual actions, intention alone is enough to predict behavior (Ajzen, 1991). This case is identical to the TRA-model (Fishbein & Ajzen, 1975). On the other hand, if the individual has less control over individual actions, the intention will be severely influenced by *perceived behavioral control*, and the individual's own confidence will affect the actual behavior. The *perceived behavioral control* will in addition to affect actual behavior, affect the behavioral intention, subjective norm and attitude towards the behavior.

3.3 Technology Acceptance Model

With the Theory of Reasoned Action (Fishbein & Ajzen, 1975) as background, Davis (1989) developed The Technology Acceptance Model (TAM) in 1986. The model predicts how humans accept and utilize informational systems on an organizational level (Davis 1989; Davis et al.,1989). The model has been validated through empirical test by among others Venkatesh & Davis (2000) and explains around 40 percent of the variance in intention of usage and actual usage.

In addition to the terms and parameters introduced in the Theory of Reasoned Action (Fishbein & Ajzen, 1975) and the Theory of Planned Behavior (Ajzen, 1991), Davis introduced *perceived* *usefulness* and *perceived ease of use* with the TAM-model. As beliefs affect attitude (Fishbein, 1963), these two elements determine the attitude towards use and the following intention and actual usage of new technology.

The Technology Acceptance Model (Davis, 1989) defines *perceived usefulness* as *"the degree to which a person believes that using a particular system would enhance his or her job performance"* (Davis, 1989;320). *Perceived usefulness* explains attitude and intention of usage in the TAM-model. Venkatesh & Davis (2000) shows that the TAM-model and *perceived usefulness* has been validated as a strong determinant of intention of usage with a standard regression coefficient around 0.6.

Davis (1989) defines *perceived ease of use* as *"the degree to which a person believes that using a particular system would be free of effort"* (Davis, 1989;320). In other words, even though the informational system is perceived useful for the user, it could be perceived as impossible or difficult to use. In this case effort from the user is needed, and is illustrated in the figure above as perceived ease of use affect both *perceived usefulness* and attitude towards usage. Later research shows that *ease of use* also influence the behavioral intention directly (Davis et al., 1989; Venkatesh & Davis, 1996).

Complementing *perceived usefulness* and *perceived ease of use*, the Technology Acceptance Model (Davis, 1989) also includes *external variables*. Davis et al. (1989) explains these as *"(...) provide the bridge between the internal beliefs, attitudes and intentions represented in TAM and the various individual differences, situational constraints and managerially controllable interventions impinging on behavior."* (Davis et al., 1989;988). In the literature, some examples of *external variables* could be user characteristics and system features (Davis et al., 1989). For user characteristics this could be, in example, level of education, age and/or gender. Yousafzai et al. (2007) have on a later stage researched 70 different external variables that can explain *perceived usefulness* and *perceived ease of use,* and as a result, part of the usage intention.

Studies proceeding the original theoretical framework have vindicated that attitude towards use has zero, or a partial mediating effect on actual intention of use, and usage of new technology

(Taylor & Todd, 1995). Furthermore, more recent studies have concluded that *perceived usefulness* and *perceived ease of use* have a direct effect on intention of use (Venkatesh & Davis, 2000)

3.3.1 Weaknesses with TAM

The Technology Acceptance Model has received criticism despite being a frequently utilized model. Yousafzai et al. (2007) shows that the TAM has been utilized on technological systems like e-mail, spreadsheets, presentation-tools and database-programs. Even though TAM has been utilized on these mentioned systems, and several more, there has been raised concerns based on the limitations of the previous research. In the following paragraphs, we will discuss these limitations and weaknesses to the TAM framework.

In most cases, TAM data is collected via self-reporting and not actual measurements of usage. As a measurement for system usage, this is highly subjective and as a result not a reliable measure (Yousafzai et al., 2007). Another methodological weakness to the TAM is that most of the studies completed are based on freedom of choice when it comes to system usage. Yousafzai et al. (2007) explains that this is not always the case. It is important to mention that Venkatesh & Davis (2000) found evidence that *perceived ease of use* and *perceived usefulness* explains *intention* of use directly in cases where it was not voluntary to utilize the given system. In the same study Venkatesh & Davis (2000) explains that intention of use is also directly explained by *subjective norm*.

Another criticism of TAM comes from Bagozzi (2007). He explains that the theoretical fundamentals of the framework are weak. As both the theoretical fundament in the link between *intention* and *actual usage* is weak, and that *intention* alone is not representative for *actual usage*. This weakness is explained by the time between intention and actual adoption, and that this timeframe could be characterized by uncertainty and other factors that impact the adoption decision. Bagozzi (2007) states that the deterministic nature of the model is unrealistic.

3.3.2 TAM use cases

The technology acceptance model (Davis, 1989) has been validated and verified in the numerous mentioned studies. As a consequence of this, the model has been utilized in different technological contexts, and have focused on different external variables. In the paragraphs below, we will deal with different studies relevant to this thesis, and towards our proposed research model design.

Todd & Taylor (1995) tested the Theory of Planned Behavior (Ajzen, 1991) and the Technology Acceptance Model (Davis, 1989) versus each other. This study looked at, among other things, the effect previous experience with a certain type of technology has on the relationship between subjective norm (TPB) and the adoption concepts from the TAM. Davis (1989) states that there is no significant connection between *subjective norm* and *intention* of use, but it was recognized that this should be researched further as there is reason to examine how social impact affect user behavior.

In their study, Todd & Taylor (1995) established that *subjective norm* has a significant effect on the *intention* towards usage of a technology. This effect was significant both for individuals with no prior knowledge of the informational system, and individuals with prior knowledge. Even though this was the case for both of the groups, the coherence was stronger for the group with no prior knowledge. As a result, individuals will be affected in a greater extent by the social norms when the experience with the technology goes towards zero. The study explains this as a consequence of the individual's moral obligation to utilize the technology in comparison to the individuals with prior knowledge. Todd & Taylor's (1995) study is highly relevant to this thesis as Blockchain technology is a relative new technology, thus, knowledge and experience is assumed to be low. In addition, Blockchain technology is highly debated in the current media landscape, and as a result interesting to measure when it comes to adoption decisions.

There are several other studies that have researched this connection and obtained evidence that subjective norm has a significant effect on usage intention (Fishbein & Ajzen, 1975; Ajzen, 1991; Venkatesh & Davis, 2000; Nysveen et al., 2005)

Since the TAM framework has not been utilized in a broad degree on Blockchain technology as an adoption case, we have limited use cases to select our external factors from. In the paper "Braving Bitcoin: A Technology Acceptance Model Analysis", Folkinshteyn & Lennon (2016) applies the TAM model on Blockchain as a financial technology as well as Bitcoin as a currency. The study revolved around collecting data from a variety of sources like documents, archival records, interviews and more. Their discussion regarding TAM extensions and external factors is highly relevant to this thesis and the further development of a solid research model.

Folkinshteyn & Lennon (2016) found that application-specific risk (perceived risk) regarding Blockchain technology adoption is significant, and that the TAM framework is a valuable model for analysis of this financial technology. Folkinshteyn & Lennon (2016) applied a research model modified from Davis (1989)'s original by Pavlou (2003). Pavlou (2003) applied concepts of trust and perceived risk in the extended TAM model to research consumer acceptance of electronic commerce. This is also in line with other research on technology adoption. However, in this thesis, we will not apply perceived risk, due to the comprehensive nature of risk as a factor, and that risk is measured in several different ways (Featherman & Pavlou, 2003). In addition, this thesis seeks to explore other factors that influence Blockchain technology adoption.

3.4 Other Relevant Literature

In the following chapter, literature suited to this thesis and the adoption of Blockchain technology will be presented. The focus will be on literature relevant to the development of the research model and external factors in the TAM framework. The external factors that will be presented has an organizational point-of-view to provide the thesis with the necessary organizational factors towards Blockchain adoption in Norwegian corporations. These external factors will complement the already mentioned ones in chapter 3.3.2.

From the paper "Organizational factors affecting Internet technology adoption" (Aguila-Obra & Padilla-Melendez, 2006), pressure from competitors *(competitive environment)* is mentioned as one of the most relevant organizational and external factors towards adoption. Competitive pressure (*competitive environment)* is defined as "*the pressure that occurs when the enterprise is compared with competitors within the industry. It can be defined as the degree of competition that occurs when the company's operation is going on*" (Qian et al., 2016:400). The finding of Aguila-Obra & Padilla-Melendez (2006) is backed from several other studies mentioned in their paper (Sadowski et al., 2002; Iacovou et al., 1995; Premkumar & Roberts, 1999). Premkumar & Roberts (1999) found that *competitive pressure,* along with *top management support* were the two determinants for adoption decisions related to over half of the technologies (communicative) measured in their study.

It is important to mention the lack of studies and use-cases related to external and organizational factors being utilized with the TAM. The above mentioned studies have not utilized this framework, but are more general studies on the adoption process. As the Internet is highly comparable with Blockchain networks and technology, we find that Aguila-Obra & Padilla-Melendez (2006) is a highly relevant paper towards the selection of external factors in the research model. From Yousafzai et al. (2007), *competitive environment* is among the 70 external factors that could explain *perceived usefulness* and *perceived ease of use*, and as a consequence, *intention.*

Igbaria et al. (1997) article regarding personal computing acceptance factors in small firms, concluded that the most important internal effort in the measured organizations for acceptance was *management support*. The same article defines *management support* as "*the perceived level of general support offered by top management ...*" (Igbaria et al., 1997;289). The research was a result of a survey completed by 358 individuals in small firms in New Zealand with an applied TAM influenced research model framework. Igbaria et al. (1997) relates their studies and findings to other previous research, which states that *management support* as an important factor for adoption of technologies (Cerveny & Sanders, 1986; Igbaria et al., 1994; Kwon & Zmud, 1987; Lucas, 1981)

In Aguila-Obra & Padilla-Meléndez (2006), top *management support* is also discussed as a supporting organizational factor (Premkumar & Roberts, 1999). In Premkumar and Roberts (1999) paper they research adoption of new information technologies in rural small businesses.

Their research concludes that *management support* is one of the top organizational factors affecting adoption of these technologies. Furthermore, their studies explain that *management support* is the top organizational factor when it comes to IT and IS adoption, which makes it highly relevant for Blockchain technology as it contains similar traits. In addition, *management support* is included as one of the 70 external factors in the TAM framework from Yousafzai et al. (2007).

Both *competitive environment* and *management support* is discussed here because they may be decisive external factors towards adoption of Blockchain and similar technologies.

The three categories of factors mentioned in the research questions has been developed from Yousafzai et al. (2007). As this thesis only utilize one factor from the “other variables” category (Yousafzai et al., 2007;269), this has been coined “social factors” in the related research question.

3.5 Theoretical Summary

The theory presented in this chapter provides the general base to understand which factors influence Blockchain adoption in Norwegian corporations. The main theoretical framework that has been discussed is the Technology Adoption Model (Davis, 1989) in addition to extensions and use-cases in regard to this model. The other discussion has included other relevant external factors in regards to adoption and the TAM framework (Davis, 1989). As a result, the thesis will present a suggested theoretical model for adoption of Blockchain technology in Norwegian corporations in the next chapter. Following a deductive approach we derive our model from the above mentioned theories.

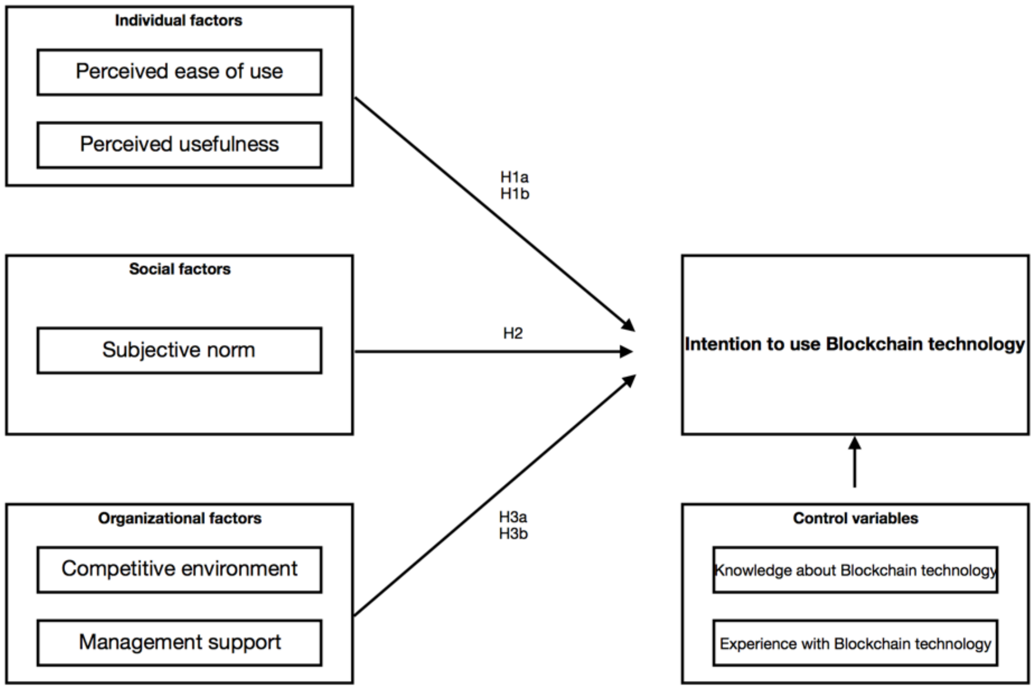
4. Model

4.1 Theoretical Model for Adoption

The theoretical model in this thesis takes origin in the TAM framework (Davis, 1989), as this is a highly validated model. As mentioned in chapter 3.3.2, the TAM framework has relevant use-cases towards adoption of technologies with similarities to Blockchain, and has been utilized and tested over time. Numerous of studies in recent years have concluded that attitude towards usage does not have a full mediating effect on intention and actual usage (see chapter 3.3). As a consequence, we will exclude attitude from the TAM framework in this thesis. Thus, our hypotheses base themselves on that *actual use* is directly explained through *usage intention*. Since *intention* directly explains *actual usage* in the TAM framework (Davis, 1989), we will forego *actual usage* in the research model, and only measure *intention* towards usage.

In the following chapter this thesis will present the suggested research model for adoption of Blockchain technology in Norwegian corporations, and the underlying hypotheses. In addition, the different factors and variables of the model will be defined.

Figure 2: Proposed Model



4.2 Definition of Factors and Variables

To complement and support the research model presented in Figure 2. above, this chapter will clearly define the different factors and variables of the model in a structured fashion. In addition, this will serve as the foundation for the future survey design and layout.

Perceived usefulness

Davis (1989) defines perceived usefulness as *"the degree to which a person believes that using a particular system would enhance his or her job performance"* (Davis, 1989;320).

Perceived ease of use

Davis (1989) defines perceived ease of use as *"the degree to which a person believes that using a particular system would be free of effort"* (Davis, 1989;320).

Subjective norm

Fishbein & Ajzen (1975) defined subjective norm as *"a person's perception that most people who are important to him think he should or should not perform the behavior in question"* (Fishbein & Ajzen, 1975;302).

<u>Competitive environment</u>

Qian et al. (2016) defines competitive pressure as *"the pressure that occurs when the enterprise is compared with competitores within the industry. It can be defined as the degree of competition that occurs when the company's operation is going on".* (Qian et al., 2016;400).

<u>Management support</u>

Igbaria et al. (1997) defines management support as *"the perceived level of general support offered by top management ..."* (Igbaria et al., 1997;289).

4.3 Hypotheses

To be able to answer the three research questions presented in chapter 1.2, we need to present measurable hypotheses. Some of the hypotheses presented in this chapter have background in the TAM framework (Davis, 1989), but are also derived from other variables that this thesis see fit for measuring influence on *intention* towards utilizing Blockchain technology. The selection of the different variables to complete our research model has been based on our own perceptions of what explains most of the variance when it comes to adoption of Blockchain technology, and relevant variables for research. Since the research on Blockchain adoption is minimal, many of the arguments have background in other similar technologies, mainly Internet technologies.

According to Venkatesh & Davis (2000), the TAM framework explains around 40 percent of the variance in usage intention. As this model has a high degree of explanatory power, this thesis will utilize the two main factors*, perceived ease of use* and *perceived usefulness*, to measure adoption of Blockchain in Norwegian corporations. The following hypotheses is presented as individual factors related to research question number 1:

H_{1a}: *Perceived ease of use has a positive influence on intention to use Blockchain technology*

H_{1b}: *Perceived usefulness has a positive influence on intention to use Blockchain technology*

Fishbein & Ajzen (1975) showed a direct effect between *subjective norm* and *usage intention*. On the other hand, Davis (1989) did not prove this connection, and as a result the factor was let out of his proposed TAM framework. Even though *subjective norm* was excluded from the model, the study commented on the need for further research related to the connection between the factor and *usage intention*. As mentioned in chapter 3.3.2, several studies have concluded that *subjective norm* is a significant explanatory variable for usage intention (Ajzen, 1991; Venkatesh & Davis 2000; Nysveen et al., 2005). Todd & Taylor's (1995) research found that this was the case for both individuals with and without experience regarding the technology. With this background, the following hypothesis is presented as a social factor related to research question number 2:

H_2: *Subjective norm has a positive influence on intention to use Blockchain technology*

Premkumar & Roberts (1999) refer to Gatignon & Robertson (1989) when they state that the greater the competitive pressure and environment is for an organization, the more likely it is that they will adopt new technologies. In addition, the study states that it is a strategic necessity towards future growth and success, to adopt technologies as a result of a present competitive environment.

Low et al. (2011) showed in their study of Enterprise Resource Planning (ERP), that *top management support* is positivly correlated with the ERP on cloud computing adoption*. Top management support* is critical for creating a supportive climate and for providing enough resources for the adoption of new technologies (Lin & Lee, 2005; Wang et al., 2010).

With this as a underlying fundament, the following hypotheses is presented as organizational factors related to research question number 3:

H_{3a}: *Competitive environment has a positive influence on intention to use Blockchain technology*

H_{3b}: *Management support has a positive influence on intention to use Blockchain technology*

5. Methodology

This chapter will thoroughly explain the methodology, research design and structure of the assignment. We also discuss some of the methodological limitations and assumptions that has been necessary in order to finish the thesis. Initially, the chapter will start out with an explanation of the choice of research design, and arguments as to why we have chosen this specific research design. To follow up on this, we will go through the process of how we structured our survey and decided on our sampling procedure. As a last point in the methodology chapter, we will discuss the stages of our planned analysis, as well as the limitations regarding statistic measures, such as validity and reliability. In terms with general research methodology, we will also have a discussion of the ethical implications of our research.

5.1 Research Design

According to Saunders et al. (2016), the research design is how one goes about to answer the proposed research questions. The research questions provide the overall objectives of the research, and the research design provides a framework to answer these questions. Furthermore, the research design is a visualization of the strategy we are using to collect the necessary data. By using the research design as a guideline for collecting and analyzing the data, we are making reasoned choices for answering the research questions the way we are. The research design is affected by resources available to the researcher. In order to complete the research within the desired timeframe, one must choose a research design that both secures the necessary statistical measures, and the completion of the research (Saunders et al., 2016).

5.1.1 Our choice of research design

For our research design, we have chosen a quantitative approach, more specifically we are collecting data using a survey that we construct, based on theory. We chose a descriptive research design, meaning that we are trying to gain an accurate insight of a specific situation, in this case the adoption of Blockchain technology (Saunders et al., 2016). Furthermore, we are trying to gain an insight into a phenomenon, meaning that the research is of exploratory nature. Ultimately, the goal is to examine the relationship between different the independent variables that affect intention to use Blockchain technology.

By using a theory-driven approach, we are following a deductive method of developing our thesis and research. The deductive approach is often used in quantitative research. This means that we are deriving the research questions and hypothesis from existing research and theory (Saunders et al., 2016), in this case, known models for technology adoption, such as the TAM framework (Davis, 1989). The use and construction of a survey for collecting data, as well as the means for analyzing the data, is based on previous research within the field of technology adoption.

5.2 Sampling

Sampling is collecting a smaller set of data which you believe is somewhat representative for the group you want to look at. In research, sampling, is often necessary due to constraints in time, budget or resources. To obtain relevant data, one needs to define a target population, and pick a sample within this target population. The requirements for people to be within the target population, is that the data they provide can provide sufficient answers to your research questions, and that the selection of your sample represents the general population you are examining (Saunders et al., 2016).

5.2.1 Sampling strategy

In our survey, we are looking at a target population that consists of people working in Banking/Finance, Consulting, Insurance, Industry/Retail and IT/Technology. These industries are the ones we believe are the most likely to be disrupted by Blockchain technology. Furthermore, as we are looking at the adoption of Blockchain technology, we believe that it is vital to choose individuals who has some knowledge of technology in general, and that after a brief introduction to Blockchain in the survey, are able to give satisfying answers to the survey questions.

For our paper, we are basing the data collection on convenience sampling, meaning that we are not choosing sample subjects at random, but rather subjects that fit our criteria and are easy to reach, we then argue that their views are somewhat representative for the target population. This is a haphazard sampling technique, meaning that we are selecting a population that is also based on the availability of the subjects (Saunders et al., 2016). Because technological knowledge is a prerequisite for being in the sample, we may receive biased answers, however, it may also affect the response rate positively as it appeals to the respondent's field of interest. Since we have chosen to use convenience sampling, we must be careful when doing subsequent interpretations, as there may be biased answers.

A criteria for a good sampling technique is the relevance between what is being studied, and the respondents. The sample also needs to be of an adequate size and the sample should be representative for the population one wish to study. For a convenience sample the representativeness is based more on subjectivity, and it is up to us to prove the representativeness of the sample (Ferber, 1977). Using the convenience sample, one reduces the chances of obtaining a representative sample, and thus the external validity of the research. However, given the restraints in time, we believe that using the convenience sample is most suitable. In more extensive future research, a probability sample would be more useful, as it will yield more credible results.

5.2.2 Sample size and distribution

There are no clear definitions of a required size for a sample. However, we aimed at obtaining the largest possible sample in order to get a good statistical base for our analysis. We aimed at distributing the survey to 200 individual respondents, and given that we contacted each respondent individually, we aimed at a high completion rate. This is in terms with Johannesen et al. (2011) which states that measured subgroups should have no less than 30 respondents. In order to increase the external validity of the thesis, we aimed at having a large number of respondents, while also staying within the boundaries for respondents that can provide sensible answers to the survey (Saunders et al., 2016).

By using the convenience sample, we were at liberty to choose our own respondents in accordance with the prerequisites for respondents we set ourselves. When selecting respondents, we started out by focusing on the industries that could benefit the most from Blockchain technology, and also utilizing our own network of contacts within the mentioned industries. In order to get a large sample size, we reached out to many of the respondents through LinkedIn, which meant that we were able to see what industry they belonged to, and what type of position they held within said company. Furthermore, we also asked the respondents to come up with additional respondents that fit within our requirements.

5.3 Measures

The research model presented in this thesis (chapter 4.1) contains six constructs, that all have measurement items that are well founded in information-system research. From Saunders et al. (2016) this operationalization is known as *"the translation of concepts into tangible indicators of their existence"* (Saunders et al., 2016;722). In the following chapter, this thesis will provide the constructs with measurable statements, and present the underlying sources. The term *"Blockchain technology"* will be utilized in the measurements as a result of its widespread application in the field (Nakamoto, 2008).

Concerning the *individual factors*, the measures for *perceived ease of use* and *perceived usefulness* were taken from Nysveen et al.'s (2005) adaptation of Davis et al.'s (1989) original items. Venkatesh & Davis (2000) was also used as background for the measurement adoption regarding *perceived ease of use*. To our knowledge there are no research on Blockchain technology that we can utilize to formulate and operationalize measures from. As a consequence, the term "Blockchain technology" will replace the "system" in the measures.

Perceived ease of use
PEoU1: Learning to use Blockchain technology is easy to me
PEoU2: It is easy to make Blockchain technology do what I want it to do
PEoU3: It is easy to use Blockchain technology
PEoU4: Interacting with Blockchain technology does not require a lot of my mental effort

Perceived usefulness

PU1: Using Blockchain technology makes me save time

PU2: Using Blockchain technology improves my efficiency

PU3: Blockchain technology is useful to me

PU4: Using Blockchain technology in my job would enable me to accomplish tasks more quickly

The *social factor*, *subjective norm* 's, measure is also taken from Nysveen et al. (2005). The term *normative pressures* are utilized in this paper, but is also defined as *social influences* in the same paper. The three measurements are almost identical to the items used in Bhattacherjee (2000). As with the individual factors, the mentioned service is replaced by ”Blockchain technology” to measure the correct technology.

Subjective norm

SN1: People important to me think I should use Blockchain technology

SN2: It is expected that people like me use Blockchain technology

SN3: People I look up to expect me to use Blockchain technology

The two *organizational factors* have primarily been adopted from Qian et al. (2016).

The measurements from *management support,* where item number 1, 2 and 4 is measured, is taken from Qian et al.'s, (2016) measurements of *top management support*. Furthermore, item number 3 is adopted from item number 1 in Igbaria et al. (1997) measuring *management support.* To clearly state that the measured *management support* is from the respondents own organization, the wording "… in my organization" has been added.

As for the measurements regarding *competitive environment*, Qian et al.'s, (2016) measures of *competitive pressure* has been utilized.

As in the individual and social factors, "Blockchain technology" has been added instead of the service measured in the mentioned sources regarding the two organizational factors.

Competitive environment

CE1: Our competitors are adopting Blockchain technology which gives our company pressure to adopt it too as they can perform their tasks efficiently by adopting it

CE2: Our key competitors get many advantages through adopting Blockchain technology

CE3: We are aware of our competitors who have adopted Blockchain technology which is perceived favorably by others in our industry

CE4: Many of our competitors are going to adopt Blockchain technology in the near future

Management support

MS1: Top management in my organization deems Blockchain technology to be essential in the operations of the company

MS2: The decision of top management in my organization is vital for the company to adopt Blockchain technology

MS3: Management in my organization is aware of the benefits that can be achieved with the use of Blockchain technology

MS4: Top management in my organization will support Blockchain technology adoption

To measure *intention*, this thesis has adopted the measurements from Giovanis et al.'s (2012) *behavioral intentions,* whose measurements is adapted from Davis (1989). The term "Blockchain technology" has replaced "Internet banking" from Giovanis et al. (2012) in this thesis.

Intention

I1: I intend to use Blockchain technology in the near future

I2: I plan to use Blockchain technology

I3: I expect to use Blockchain technology in the near future

In addition to the mentioned six constructs, the questionnaire included control variables related to *knowledge* and *experience,* and *age, gender, industry* and *position* as demographic measurements.

The control variables are included as constants to assess the relationship between the other constructs in the survey. The question related to both *knowledge* and *experience* is adopted from the measurements from Nysveen & Pedersen (2004). Both constructs are based on the *experience* statement, and adopted to measure Blockchain technology knowledge and experience. There is one item per measurement. As a result, we have a case of mono-operation bias that could lead to the item's failure to capture the entirety of the measurement (Nysveen, 1999). This needs to be taken into consideration, but as other studies have overcome this challenge, we will continue with the mentioned items.

Experience
1: I feel that I am an experienced user of Blockchain technology

Knowledge
1: I feel that I have in-depth knowledge of Blockchain technology

The demographic measurements were added to the model to avoid confounding results due to specific individual characteristics and to provide the data with depth. The measurements regarding *industry* are taken from the 2.2 chapter on different categories of corporations who could utilize Blockchain technology. There are countless use cases towards Blockchain technology, thus we included the industry category "other". The measurement in regard to *position* is added from a standard hierarchy in consulting, banking and the other main industries measured in this study.

5.3.1 Measuring scale

With the exception of the four demographic measurements, all of the six constructs and the two control variables are measured using statements on a 7-point Likert-type scale ranging from *strongly disagree* to *strongly agree.* This scale is commonly utilized in adoption studies, similar to the studies our measurements and items are adopted from, and measures to which degree the respondents agree or disagree to the different statements.

5.3.2 Layout

As we wanted to increase the amount of responses, the model and corresponding survey (Appendix G), was created with this in mind. As a consequence the 28 questions reflected a pretty concise and time effective survey. The questionnaire layout and order of questions should be logical, which will benefit the survey and the results (Saunders et al., 2016).

The questionnaire is mainly presented in a matrix form, and consists of different grids related to the different measurements and the number of related items. This makes it possible for the respondent to answer similar types of questions quickly and at the same time (Saunders et al., 2016).

At the start of the survey, a brief introduction regarding Blockchain Technology was added together with general information about the process. The general information provided the respondents with information regarding anonymity, the number of questions, the usage of the responses, that there is no wrong answer, that the entire scale can be utilized and that the survey is voluntary and could be stopped at any time. The Blockchain technology introduction was included to provide the respondents with some general information about the technology, and so that all the respondents had a clear understanding of which technology that the survey measured.

5.3.3 Pilot test

To be able to test the survey before distribution, we completed a small pilot test. We decided to conduct such a test after the completion of the survey to be able to avoid distributing a survey containing errors or misinterpretations (Saunders et al., 2016). The pilot test was completed by three individuals, which did not participate in the general survey. They were able to confirm that our measurements and constructs where understandable and possible to answer. In addition, we wanted to check if the layout was user-friendly, and that the distribution mechanisms in Qualtrics worked properly. As a consequence, we did not alter our survey after the pilot test. The participants of the pilot test used on average about 4 minutes to complete the survey.

5.4 Reliability and Validity

5.4.1 Reliability

Reliability concerns the consistency of a measure. More specifically it refers to the quality of the research, for instance that the research can be replicated with the same procedure and would achieve the same results. Reliability also concerns errors and biases in the data and how measures are taken to avoid those errors and remove biases. There are four main threats to reliability, namely participant error, participant bias, researcher error and researcher bias (Saunders et al., 2016).

Observer bias and error is often a fallacy resulting from open-ended questions and observer subjective interpretation in research (Saunders et al., 2016). This was countered by distributing a survey with close-ended questions to respondents that could not be identified by the observers. The survey was distributed using the Qualtrics service, which does not let you alter the responses before exporting the data, effectively reducing the chances of observer bias in the data collection phase. By automatically exporting data into the statistics software, SPSS, the risk of human error such as plotting errors or misinterpretation were reduced.

During the distribution phase there was some feedback from the respondents on lack of knowledge regarding Blockchain technology. We feared that the lack of knowledge might result in participant error. However, as we are measuring both future and present adoption, we believe the answers of respondents with lower level of knowledge as important. We also included a control variable in order to control for previous knowledge and experience with Blockchain technology.

The participants were ensured anonymity to counter biased responses from the participants. The participants were not informed about the purpose of the survey, other than that the topic was Blockchain technology, and that we wanted their professional opinion on the matter through the survey. The fact that the thesis concerns adoption of the technology was not disclosed in the initial contact phases, or in the introductory text in the survey. However, some of the respondents may have realized what we were trying to measure, as we use relatively well-known adoption theories. There is a slight chance of participant bias, however, we believe this was countered by the above-mentioned measures.

In order to face these threats to reliability, one needs to be rigorous and methodological (Saunders et al., 2016). The plan was initially to distribute the survey at an earlier point in time, however, by postponing this, it was easier to apply measures to reduce the threats to reliability. By using the distribution service provided by Qualtrics, while also including relevant control variables, the chance of errors either from the researchers or the participants were reduced. The survey and data collection was completely automatized, and the only possible researcher bias is during the analysis and interpretation phase.

5.4.2 Validity

Validity concerns accuracy of the analysis and results as well as appropriateness of measures and generalizability. The three most common aspects to validity is measurement, internal and external validity (Saunders et al., 2016). This part will focus on the measures taken to address internal and external validity in this thesis, more specifically we will discuss criteria for credibility and transferability.

Internal validity is a measure used to describe potential causal relationships in research. The theoretical framework of this thesis is used to predict causal relationships; however, we have to consider the threats to internal validity in this specific research. Common threats to internal validity are population threats, for instance maturation and selection (Saunders et al., 2016). In this specific research, the internal validity is not particularly good, however, as it is based on a model that usually predicts a causal relationship between the dependent and the independent variable, there is an argument for a certain degree of internal validity.

Credibility is a measure concerning the match of constructs of research participants and researches (Saunders et al., 2016). Prior to the distribution of the survey, we completed a test of the survey with three participants in order to receive feedback on the construction of the survey.

Furthermore, the analysis was developed thoroughly, and irrelevant data was removed to increase credibility. The credibility measure concerns the internal validity of the research.

The second measure assessed was transferability. This measure concerns the generalizability of the research, more specifically the detailed description of research design, context and research questions (Saunders et al., 2016). The development of our research questions is thoroughly explained in the thesis, furthermore, the research design shows a detailed description of how we conducted our research. The context chapter provides the necessary setting for external readers to gain an insight into the topic and theories. All in all, the reader or recipient of the research is suited to evaluate the transferability and generalizability of the research.

5.5. Ethical Considerations

When conducting research, there are several ethical implications and considerations that need to be addressed by the researchers. These considerations concern the gathering and storage of personal data, as well as ensuring the anonymity of the participants. The choices done by the researchers, and the way the research is conducted, needs to take into account who the participants of the research are and who is affected by it (Saunders et al., 2016). In Norway, principles of research ethics is decided and governed by independent committees funded by the government (Regjeringen, 2014). Saunders et al. (2016) proposes several ethical principles to consider when conducting research, we have chosen to comment on i) Integrity and objectivity, ii) Respect, iii) Privacy and anonymity of respondents, iv) Responsibility in analysis of the data and v) Voluntary nature and right to withdraw.

In terms of objectivity and integrity, measures to be considered are researcher biases and dishonesty (Saunders et al., 2016). In our case we have been communicating clearly the aim of our research to those involved, including our supervisor. Furthermore, we have communicated to the participants of their research that we are conducting research for a master thesis at the Norwegian School of Economics, and that the data collection is solely for this use.

Respect concerns social responsibility and obligations towards those who participate or are affected by the research (Saunders et al., 2016). The respondents have been informed of their rights to see the published thesis once it is completed and graded, and those with further questions regarding the research have been contacted. People who stated that they were negative towards the objectives of the research were also listened to, although we did not do any alterations because of this.

The survey collected the e-mail addresses of the participants, as well as asking for their gender, age group and level of seniority in the workplace. The e-mail addresses were used solely for the distribution of the survey through the Qualtrics-software. Furthermore, the survey was distributed in such a manner that the participants could not see the addresses of the other recipients, we also used the settings from Qualtrics to anonymize responses. The variables of age, gender and seniority were not used to identify participants, but rather as variables that provide depth to the demographic analysis of the sample.

The extracted data from the Qualtrics-software did not contain the email addresses of the recipients, ensuring that the analysis of the data is responsible in terms of anonymity. Furthermore, the data was extracted directly from the software without any alterations or tampering from us. Although we have provided hypotheses for the output of this research, we have not manipulated any of the data or results in order to fit our hypotheses. In our view, it is just as important for research to report results that show no causality within a field, as this saves future research from using the same approach and hypotheses for causality.

Regarding the voluntary nature of the participation, we used a non-probability sample where we personally reached out to all respondents regarding the distribution of the survey. They were all contacted with a polite message asking if they had the possibility to contribute to the research and/or wished to receive the completed thesis, once graded. They were also informed of the average completion time of the survey. The distributed survey is presented in full in Appendix G.

All in all, we strived to act in accordance to the principals of ethical research. We followed the guidelines stated both in Saunders et al. (2016) and from the Norwegian committees of research ethics. Being conservative in regard to the number of reminders sent out to the participants was also something we stressed, for instance we only sent out one-time reminders to participants who had not finished the survey. All the participants also received a personal thank you note for participating in the survey. The output from both Qualtrics and SPSS provides accuracy in the collection and analysis of the data. Limitations and weaknesses to the thesis, collection and analysis of data are also commented in the thesis.

6. Data Description and Validation

The collected data was analyzed using SPSS, a software used for logical statistical analysis. The output and interpretation of the data will be presented in this chapter. Additional tables and visualizations of the output is presented in the appendix.

6.1 Survey and Sample Demographics

We distributed an online survey in order to test our hypotheses. The survey was distributed to 180 unique respondents. All possible respondents were contacted beforehand in order obtain their email addresses, and no emails were sent out at random. In total we reached out to over 250 persons in order to get as high a response rate as possible, however, some of the persons did not respond or wish to participate, resulting in a total of 180 recipients. Out of the 180 recipients, we received a total of 102 complete responses, excluding those who did not finish their surveys. We also encountered situations where recipients who wished to participate managed to delete the emails with the unique link to the survey. These respondents were not provided with a new link to the survey, as this could contaminate our data. Some of the respondents also commented that they did not have the necessary knowledge for completing the survey, although they had agreed to participate before receiving it. Some respondents did not open the emails with the survey. In some cases, the emails were sorted out by the organizations spam filter.

Table 1: Sample Demographics

	N=102	
	Frequency	**Percent (%)**
Gender		
Male	83	81.4
Female	19	18.6
Age		
18-24	10	9.8
25-39	82	80.4
40-54	10	9.8
Seniority		
Entry Level/Junior	56	54.9
Senior	16	15.7
Manager	12	11.8
Partner/Management	13	12.7
Other	5	4.9
Industry		
Consulting	42	41.2
Banking/Finance	22	21.6
IT/Technology	17	16.7
Insurance	4	3.9
Industry/Retail	7	6.9
Other	10	9.8

We excluded partial survey responses (N=17), in order to get more valid data, resulting in the total number of responses analyzed being N=102. After pilot testing the survey with three respondents in different age and seniority levels, we estimated that a completion time around 3-4 minutes would be acceptable. The Qualtrics software we used to distribute the survey estimated 3-5 minutes for completion of the survey. Adding to this, it is likely that some individuals will complete the survey faster than this, if they are not distracted during the completion, or they have vast knowledge of the subject. To compensate for this, we set the minimum threshold for responses to two minutes, which was all monitored in the Qualtrics software. The reason for setting a minimum threshold is to avoid careless responses. None of the fully completed surveys were below two minutes, resulting in the final number of included responses being 102.

The demographic representation in Table 1 shows an overview of the sample. Looking at the genders, one can see that 81.4 percent the respondents are male (N=83). This is not representative to the gender representation in the Norwegian workforce, where males constitute approximately 53 percent of the workforce (SSB, 2017). Similarly, the age group 25-39 and junior level employees are overrepresented in the sample. We believe this is due to our choice of a convenience sample, and the utilization of our own network for sampling. There is a fair reason to believe that the gender, age and seniority distribution would be more even if a probabilistic sampling method were used. The same reasons apply to industry, where we see Consulting and Banking/Finance being overrepresented (N=42+22).

6.2 Statistical Analysis

6.2.1 Factor analysis

Since the research model in this thesis is developed from an extended TAM framework, a factor analysis was completed with the assumption that we would find six factors. Three of these was a part of the original TAM framework, while the other three are external factors added to the research model. As well as confirming the six factors, the analysis included an evaluation of the different factor loadings. All factor loadings in the range of 0.3 to 0.4 is considered to meet the minimal level to interpret the structure, and levels over 0.5 and 0.7 is considered to be significant and well-defined. The latter is the goal values when it comes to factor analysis. If some of the items did not comply with this, they would be removed from the measurement and model. In addition, the main factor loading should not differ with less than 0.2 with regards to the next factor in loading value (Hair et al., 2006).

The factor analysis was completed with an oblique rotation because the research model is in large part a result of the TAM framework, thus it is expected that the some of the factors will correlate (Davis, 1989). Oblique rotation will take this correlation into account.

Pattern Matrix[a] in Appendix A, shows the different measures and factor loadings on the six different factors for all of the original items. As the results show, item 3 and 4 measuring *perceived usefulness* have below significant factor loadings. In addition they load on several different factors. Even though item 4 is in part significant, because of its loading level over 0.5, it is still borderline, and thus removed from the next factor analysis, together with item 3.

Table 2. Pattern Matrix[b]

	Factor					
	1	2	3	4	5	6
$PEoU_1$	-.055	.111	.101	**.721**	.069	-.022
$PEoU_2$	.184	.069	-.004	**.693**	.067	-.054
$PEoU_3$	.105	-.076	.060	**.884**	.036	-.022
$PEoU_4$	-.079	-.041	-.053	**.653**	-.060	.063
PU_1	**.909**	.047	-.023	.039	-.030	.088
PU_2	**.983**	-.026	.042	.004	.063	-.085
SN_1	.043	-.017	.007	.088	**.770**	-.057
SN_2	.010	.063	.058	-.053	**.805**	.068
SN_3	-.040	.028	-.045	-.030	**.843**	.086
CE_1	.063	-.070	**.902**	.015	.006	.080
CE_2	.046	-.033	**.872**	-.006	.040	-.064
CE_3	-.094	.129	**.725**	.059	.033	-.014
CE_4	-.014	.017	**.739**	-.028	-.053	.084
MS_1	.074	.105	.186	-.009	.212	**.477**
MS_2	.222	.104	.112	-.004	-.005	**.511**
MS_3	-.078	-.087	.050	-.008	-097	**.555**
MS_4	-.008	.086	-.008	.041	-.012	**.702**
I_1	.005	**.920**	.026	-.027	-.029	.090
I_2	.038	**.911**	-.058	-.005	.030	.078
I_3	-.024	**.896**	.082	.045	.090	-.141

Extraction Method: Maximum Likelihood.

Rotation Method: Oblimin with Kaiser Normalization[a].

a. Rotation converged in 9 iterations.

Table 2. Pattern Matrix[b] shows the different measures and factor loadings after PU3 and PU4 have been removed. There is some convergence on items 1 and 2 regarding *management support*. This may be explained by the high level of entry-level staffers completing the survey. One reason might be that they do not have the necessary insight to what the top management

think about Blockchain technology, and that their answers reflects this. Overall, the matrix shows that all the factors have significant and well-defined factor loadings. With the factor analysis as the background, the survey seems to be designed correctly, and most of the respondents have answered the questions seriously.

6.2.2 Reliability and validity measures

After the factor analysis, a test of the reliability of the measures were completed. This to be able to check the quality of the research among the other factors mentioned in chapter 5.4. The reliability measures is presented in Table 3. Items and Convergent Validity, together with the different constructs, items, factor and factor loadings. To be able to measure the different constructs, the items were computed into different terms.

Table 3. Items and Convergent Validity

Construct	Item	Description	Loadings	α	Eigenvalue	% of variance
Perceived Ease of Use	**PEoU1**	Learning to use Blockchain technology is easy to me	.721	.843	1.577	7.886
	PEoU2	It is easy to make Blockchain technology do what I want it to do	.693			
	PEoU3	It is easy to use Blockchain technology	.884			
	PEoU4	Interacting with Blockchain technology does not require a lot of my mental effort	.653			
Perceived Usefulness	**PU1**	Using Blockchain technology makes me save time	.909	.956	7.412	37.059
	PU2	Using Blockchain technology improves my efficiency	.983			
	~~**PU3**~~	~~Blockchain technology is useful to me~~				
	~~**PU4**~~	~~Using Blockchain technology in my job would enable me to accomplish tasks more quickly~~				
Subjective Norm	**SN1**	People important to me think I should use Blockchain technology	.770	.873	1.248	6.238
	SN2	It is expected that people like me use Blockchain technology	.805			
	SN3	People I look up to expect me to use Blockchain technology	.843			
Competitive Environment	**CE1**	Our competitors are adopting Blockchain technology which gives our company pressure to adopt it too as they can perform their tasks efficiently by adopting it	.902	.900	1.844	9.220
	CE2	Our key competitors get many advantages through adopting Blockchain technology	.872			
	CE3	We are aware of our competitors who have adopted Blockchain technology which is perceived favorably by others in our industry	.725			
	CE4	Many of our competitors are going to adopt Blockchain technology in the near future	.739			
Management Support	**MS1**	Top management in my organization deems Blockchain technology to be essential in the operations of the company	.477	.760	1.041	5.207
	MS2	The decision of top management in my organization is vital for the company to adopt Blockchain technology	.511			
	MS3	Management in my organization is aware of the benefits that can be achieved with the use of Blockchain technology	.555			
	MS4	Top management in my organization will support Blockchain technology adoption	.702			
Intention	**I1**	I intend to use Blockchain technology in the near future	.920	.954	2.592	12.962
	I2	I plan to use Blockchain technology	.911			
	I3	I expect to use Blockchain technology in the near future	.896			

The eigenvalues presented in the table above, illustrates the rank in variance explained by each of the factors in the research model. The lower limit for eigenvalues is 1.00 for the factor to be considered stable, and all factors with a value below 1.00 should as a consequence be excluded from the model (Hair et al., 2006). As Table 3 shows, all of the six factors have an eigenvalue over 1.0 with the lowest at 1.041 (*management support*), and the highest at 7.412 (*perceived usefulness*). Furthermore, *management support* as a factor explains 5.207 % of the model variance, and *perceived usefulness* explains 37.059 %.

The results from the conducted Cronbach Alpha-test is also presented in Table 3. The alpha-values assess the consistency of the scale in its entirety, and if the factors are stable enough to be utilized as a scale. From Hair et al. (2006) the lower generally agreed upon limit is 0.7. As the results show, all the factors score above 0.7, and is deemed stable enough to be utilized as a scale (Hair et al., 2006).

To measure construct validity, we completed a correlation analysis between each of the six constructs, and each of the two control variables. This was done to test if the constructs differed from the other constructs measured, and also if they shared significant coefficients, as they are part of the same model (Hair et al., 2006).

Table 4. Correlation Matrix

	PEoU	PU	SN	CE	MS	I	Knowledge	Experience
PEoU	1							
PU	.295**	1						
SN	.272**	.251**	1					
CE	.290**	.285**	.484**	1				
MS	.127	.223*	.509**	.586**	1			
I	.202*	.314*	.532**	.453**	.432**	1		
Knowledge	.058	.012	.325**	.215*	.264**	.449**	1	
Experience	.098	.109	.420**	.292**	.340**	.577**	.764**	1

The numbers off the diagonal are the correlations between the factors/constructs.

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

None of the construct correlations exceed 0.8 as this is a cut-off value for multicollinearity (Berry & Feldman, 1985). The highest correlation is between *experience* and *knowledge* (.764). As a result, there is acceptable discriminance between the factors related to multicollinearity problems. In addition, the factors had a fair share of significant coefficients, and thus part of the same model.

6.2.3 Descriptive statistics

Table 5. Descriptives and Normality Indicators

N=102								
	Minimum	**Maximum**	**Mean**	**Std. Deviation**	**Skewness**		**Kurtosis**	
Construct	**Statistic**	**Statistic**	**Statistic**	**Statistic**	**Statistic**	**Std. Error**	**Statistic**	**Std. Error**
PEoU	1.00	5.75	3.3799	1.03988	-.309	.239	-.473	.474
PU	1.00	6.50	4.0637	1.17665	-.514	.239	.820	.474
SN	1.00	7.00	3.5915	1.49506	.108	.239	-.742	.474
CE	1.00	7.00	3.8309	1.43901	-.050	.239	-.797	.474
MS	1.00	7.00	4.3971	1.25092	-.096	.239	-.484	.474
I	1.00	7.00	4.2582	1.65966	-.107	.239	-.969	.474
Knowledge	1.00	7	3.13	1.912	.508	.239	-1.008	.474
Experience	1.00	7	2.27	.1562	1.281	.239	.802	.474

The descriptive statistics from the analysis is reported in table above, more specifically by minimum and maximum values for each construct, as well as the mean, kurtosis and skewness. The minimum, maximum and mean values for each construct tells us the distribution of answers in the 7-point Likert scale used to measure the constructs. *Experience* (2.27) and *knowledge* (*3.13*) have means that are low relative to the other constructs, while *management support* (*MS*) scores the highest mean value (4.3971).

Skewness concerns the symmetry of the distribution as compared to a normal distribution. Values outside the threshold between -1 and 1 are considered substantially skewed (Hair et al., 2006). In this case, we see that this applies to the *experience* construct (1.281), meaning that the distribution is skewed. The rest of the constructs are within the threshold.

Kurtosis measures flatness or peakness compared to a normal distribution. Positive values indicate a peak, whereas negative values indicate flat distributions (Hair et al., 2006). The *knowledge* kurtosis value (-1.008), and *perceived intention* (-.969) are the highest values. These values indicate a relatively flat distribution for the two constructs. Looking at the histogram in Appendix F, we see that the distribution is close to a normal distribution, with a mean value of 3.54, this is supported by the residual plot where the data points are relatively even distributed on the diagonal line. However, we see that the distribution is relatively centered, with small tails. This is supported by the data set, which indicates that most answers center around the mean value.

Whereas the kurtosis values are all within the threshold, which is between -1.96 and 1.96 (Rose et al., 2015), there are indications of a skewed distribution for the *experience* construct. This means that the distribution is asymmetrical for this construct, which is in line with our assumption that most organizations have yet to fully operationalize Blockchain technology, and thus the *experience* is low. This assumption is supported by the low mean value of the *experience* construct.

7. Results

The hypotheses were tested with a regression analysis with *intention* to use Blockchain technology as the dependent variable. Table 6. Regression Output presents the parameter values and significance levels for the regression analysis, for the different independent variables. The regression was completed both with and without control variables (see Appendix E.), with standard beta coefficients, significance levels, T-values, Tolerance-values and Variance Inflation Factor-values (VIF) as measures.

The significance of an independent variable's effect on a dependent variable is decided at a threshold significance level of less than .05. Furthermore, the adjusted r-squared value (.457) shows the model accuracy of the linear model in SPSS.

VIF-values address multicollinearity in linear regressions, the value is always above 1, and preferably below 2.5 or 4, however, the threshold levels vary in different research. For instance, O'Brian (2007) discusses the general rule of thumb that VIF-values below 4 indicates low multicollinearity, however, this depends on the strength of the model. From the table below, we see that these numbers indicate a good fit, although the values for the control variables are close to the upper preferred threshold. If the VIF-values exceed the threshold levels, researchers may want to exclude certain variables from their research, to reduce the multicollinearity (O'Brian, 2007). Similarly, the Tolerance-values is also an indicator of multicollinearity, where one can interpret that that small values indicate linear relationships between the independent variables. There are no clear threshold values for Tolerance, however, some researches argue that values below .1 should be investigated. The VIF- and Tolerance-values are both measuring collinearity, and are related mathematically (O'Brian, 2007).

We deem the VIF- and Tolerance-values as acceptable, within the threshold of < 2.5 or < 4 for VIF, and $> .1$ for Tolerance, we have not taken any further measures to reduce multicollinearity.

Table 6. Regression Output

Including control variables

N=102					
	Standard coefficients beta	**Sig.**	**T-value**	**VIF**	**Tolerance**
PEoU	.005	.946	.068	1.192	.839
PU	.162	**.045**	2.031	1.181	.847
SN	.218	**.023**	2.314	1.648	.607
CE	.147	.132	1.518	1.747	.573
MS	.060	.537	.620	1.748	.572
Knowledge	.048	.679	.416	2.436	.411
Experience	.368	**.003**	3.075	2.658	.376
F-Value		13.120			
R^2		.494			
R^2 Adj.		**.457**			

From the table we see significant values on variables *perceived usefulness* with a beta-value of .162 (p=.045)*, subjective norm at* .218 (p=.023) and *experience* at .368 (p=.003). The output is compared with our initial hypotheses from chapter 4.3, which all use *intention* as a dependent variable. In essence, we see which variables have a significant effect on the sample subjects' *intention* to use Blockchain technology in the future. We will now confirm or reject the hypotheses in the order they were presented in chapter 4.3. Values for significance are compared to a threshold value of less than .05

H_{1a}: *Perceived ease of use has a positive influence on intention to use Blockchain technology*

H_{1b}: *Perceived usefulness has a positive influence on intention to use Blockchain technology*

As we see from the table above, H_{1a} has to be rejected due to non-significant values at .005 (p=.946) of *perceived ease of use* on intention to use Blockchain Technology. However, the value for *perceived usefulness* is significant at .162 (p=.045), meaning that *perceived usefulness* affects intention, thus, the hypothesis is confirmed.

H_2: *Subjective norm has a positive influence on intention to use Blockchain technology*

The table indicates significant values for *subjective norm* with a beta of .218 (p=.023) on participants intention to use Blockchain technology. Thus, we confirm H_2.

H_{3a}: *Competitive environment has a positive influence on intention to use Blockchain technology*

H_{3b}: *Management support has a positive influence on intention to use Blockchain technology*

From the above table, the beta for *competitive environment* is .147 (p=.132), meaning that it is not significant. Furthermore, the values for *management support* are .537 (p=.060), which is outside the mentioned threshold. As a result we reject both H_{3a} and H_{3b}.

We did a regression both with and without the control variables, in order to see how they affected the final results of the analysis. The table shows significant values for *experience*, essentially meaning that the variable has a significant effect on the *intention* to use or adopt the technology. However, we did not include the control variables in hypotheses as we wanted to look at how they affected the significance of the other variables.

The regression output excluding the control variables, is shown in Appendix E. We see a difference in significance from the two regressions, for instance with *subjective norm* being significant, when the control variables are included.

Figure 3. Conceptual Model with Regression Output

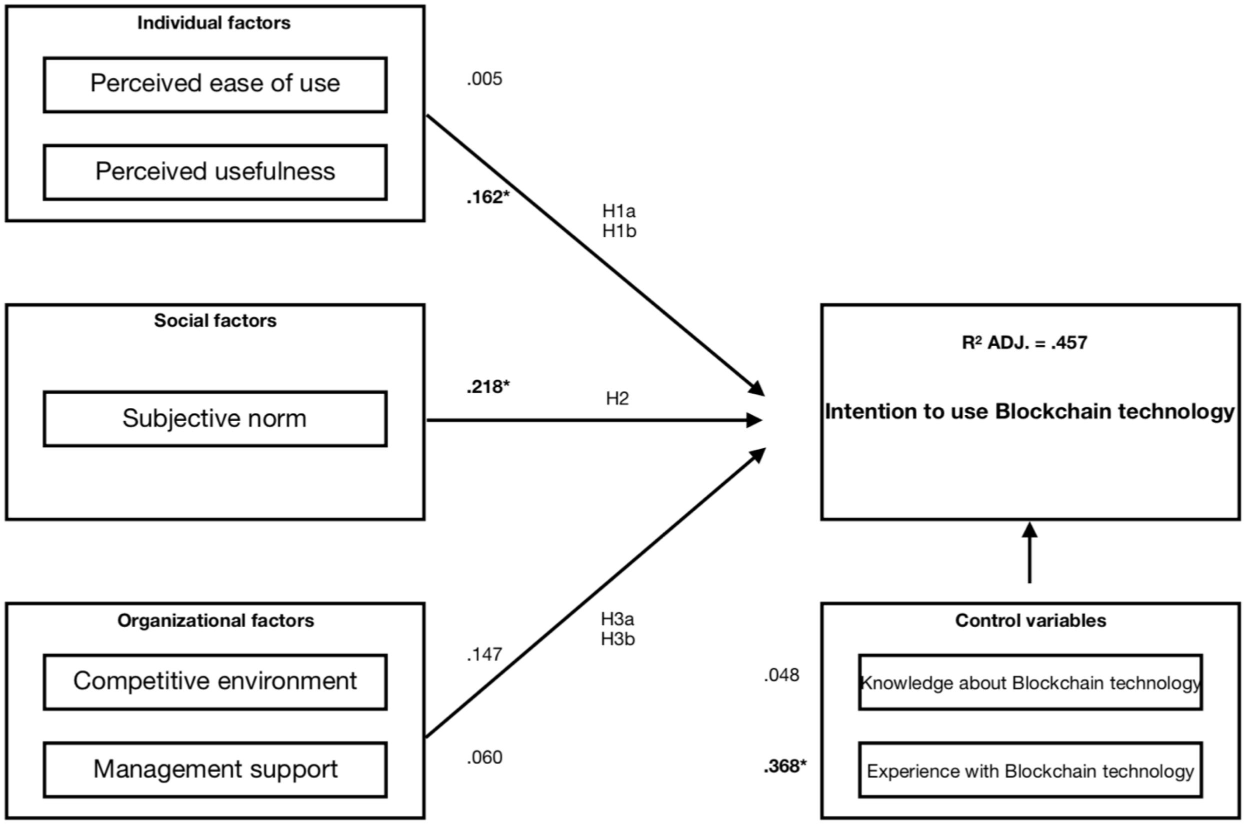


Figure 3 above, shows the relationship between factors, the underlying variables and the *intention* to use Blockchain technology. Extended from figure 2, which shows the factors, this figure visualizes the output from table 6 by showing the beta, with bold text for significance, for each independent variable on the dependent variable. We see that the two independent variables *perceived usefulness* and *subjective norm* has significant beta coefficients at .162 (p=.045) and .218 (p=.023), while the control variable *experience* with Blockchain technology is also significant.

8. Discussion

In this chapter we will discuss the interpretation of the statistical findings from the survey, and look into the implications the findings have on a theoretical and managerial level. Furthermore, the chapter will mention the limitations of the conducted research and present possibilities for future research.

8.1 Hypotheses Testing and Research Questions

Table 7. Results of Hypotheses

	Hypothesis	Support / Not Support
H_{1a}:	Perceived ease of use has a positive influence on intention to use Blockchain technology	Not Support
H_{1b}:	Perceived usefulness has a positive influence on intention to use Blockchain technology	**Support**
H_{2}:	Subjective norm has a positive influence on intention to use Blockchain technology	**Support**
H_{3a}:	Competitive environment has a positive influence on intention to use Blockchain technology	Not Support
H_{3b}:	Management support has a positive influence on intention to use Blockchain technology	Not Support

The regression model explains approximately half of the variance (45.7 %) in the intention to adopt Blockchain technology. By using the statistical output and comparing the results to our initial hypotheses, we find no support for two out of the initial five. As shown in the above table,

H_{1b} and H_2 are confirmed, and have support from the statistical analysis. This leads us to the research questions we initially presented in chapter 1.2.

RQ_1: Which individual factors affect Norwegian corporations' intention of usage of Blockchain-technology?

We tested two different individual factors, obtained from Davis' (1989) TAM framework, more specifically, *perceived ease of use* and *perceived usefulness*. As seen in Figure 3, we were only able to show significant values for *perceived usefulness*. In essence this means that the answer to *RQ_1,* is that *perceived usefulness* of Blockchain technology is the individual factor that affect Norwegian corporations' *intention* to use the technology.

RQ_2: Which social factors influence Blockchain adoption in Norwegian corporations?

Subjective norm, obtained from the TRA (Fishbein & Ajzen, 1975) and the TPB (Ajzen, 1991), was the only social factor tested in this thesis. This variable is referred to in hypothesis 2, indicating a significant positive influence on the *intention* to use Blockchain technology. The output from the analysis confirms this relationship, with a significant beta value of .218 ($p=.023$).

RQ_3: Which organizational factors influence Blockchain adoption in Norwegian corporations?

Existing theory concerning technology adoption, has also stressed the significance of organizational factors, especially *competitive environment* and *management support* (Aguila-Obra & Padilla-Melendez, 2006; Premkumar & Roberts, 1999). We included these variables in our research in order to discover if these had an influence on the *intention* to use Blockchain technology. From the output of our analysis, we did not discover a significant relationship between organizational factors and *intention* to use Blockchain technology.

8.2 Theoretical Implications

This study has utilized the Technology Acceptance Model (Davis, 1989) as a main framework, and as a result the main theoretical implications consider this theory. This thesis have been able to find support that *perceived usefulness* affects the *intention* to utilize new technology, in this case, Blockchain technology. On the other hand, results from the research does not support *perceived ease of use* as a significant variable that affects the *intention* decision regarding Blockchain technology adoption. The TAM framework is already well established and confirmed in research, even though our research shows no significance for *perceived ease of use* on adoption, it is already established as a relevant factor for other applications of the TAM framework.

The results also confirm that the TAM framework is suitable to utilize when it comes to new technologies, and that while it is still soon 30-years in the making, it is still measuring parts of the adoption intention. As mentioned in the chapter regarding theory, Venkatesh & Davis (2000) found evidence that the TAM framework explains around 40 percent of the variance in *intention* of usage and *actual* usage. In our extended model, given our research limitations, we are able to explain 45.7 % of the variance in *intention* of Blockchain technology usage in Norwegian corporations. This implies that the TAM framework could be extended with the help of multiple external factors to explain more of the variance for adoption of specific technologies than the model in its original form.

Subjective norm, was the one external social factor measured in regard to usage *intention* towards Blockchain technology in Norwegian corporations. We found the same effect as Todd & Taylor (1995), as well as the other studies mentioned in chapter 3, in regards to *subjective norms* effect on usage *intention* in the TAM framework. In addition, this study and the results support the Theory of Reasoned Action (Fishbein & Ajzen, 1975) and Theory of Planned Behavior (Ajzen, 1991) when it comes to *subjective norm* as a factor that in part explains the usage *intention*. Furthermore, the study found the same connection between *experience* and *knowledge*, and *subjective norms* as Todd & Taylor (1995). The analysis with the control variables contained evidence that *subjective norm* was a significant factor towards *intention*, while the *experience* and *knowledge* of the sample measured was low. It is fair to assume, following Todd & Taylor (1995), that *subjective norm* would be less significant if the *experience* and *knowledge* was higher.

The organizational factors, and their significance on usage *intention* towards Blockchain technology*,* was also analyzed in this thesis. As both *management support* and *competitive environment* was not significant factors on Blockchain adoption, and as a result the theoretical implications regarding the organizational factors were slim.

There is little previous research using the TAM framework, or other adoption theories, on Blockchain technology. The most comparable theoretical contribution is the Braving Bitcoin paper by Folkhinshteyn & Lennon (2016), however, they limit their research mainly to Bitcoin, rather than Blockchain technology as a whole. Furthermore, they only examine perceived risk in addition to the TAM framework factors, and thus, do not explore other possible variables and their effect on usage intention for Blockchain technology. In that case, this thesis will provide a natural supplement to existing research within the field, as we apply the TAM framework on Blockchain technology in Norwegian corporations.

In the case of data collection, as far as the writers of this thesis is aware, there are no adoption studies related to Blockchain technology which have utilized a survey as a method for data collection and analysis. Folkhinshteyn & Lennon (2016) did not base their Blockchain study on this type of collected data. As a result, the research design in this thesis will provide another approach to collect data measuring the adoption of this technology.

8.3 Managerial Implications

This research seeks to show how employees view the adoption of Blockchain technology in their company, however, it is up to managers of companies whether they decide to adopt Blockchain technology or not. If they decide to adopt and operationalize the technology, the outcome of this research is of interest, as our results give good indication as to what barriers the managers and executives may face when trying to operationalize the technology. As will be discussed in the chapter below, the generalizability of the findings is uncertain, and should not be interpreted as a recipe for how to operationalize a new technology. However, it is worth considering the causal relationship between some of the variables, if one wishes to operationalize Blockchain technology.

Initially we discussed different industries, and how they may take use of Blockchain technology. Insurance is a sector with many potential use cases for Blockchain technology. Furthermore, we believe the finance sector to be disrupted by the technology. Our thesis shows that the *perceived usefulness* is important for intention to adopt Blockchain. This implies that employees in the corporations looking to operationalize Blockchain must be informed of the potential benefits of using the technology over existing solutions. *Subjective norm* is also significant for intention to adopt, however, when we control for *experience* and *knowledge* with the technology, we see that the significance of this variable is lower. In essence, this means that employees tend to value the opinions of employees around them when they are unfamiliar with a technology. This supports the above argument that those in power of choosing whether or not to adopt Blockchain technology, should educate the employees, in order to weigh factual information on the usefulness over the opinions of their peers. Furthermore, the significance of *experience* as a control variable, indicates that employees need actual exposure to the technology to gain experience.

There is reason to believe that the attitudes towards adoption of a technology will change over time. While now being a disruptor to traditional technology, it is natural that over time, a new technology will create new areas of business instead of just replacing existing systems. This is in line with what Iansiti and Lakhani (2017) discusses, when they mention four phases of technology adoption. The fourth phase is transformation, and there is reason to believe that factors affecting adoption will be different in the transformational phase than in the single-use or substitutional phase. For instance, *ease of use* could play a more central role in Blockchain adoption when it reaches another phase, as the users will be more educated in the field.

Finally, we saw no significance on the *organizational factors* measured, namely *management support* and *competitive environment*. However, as Blockchain technology has yet to be operationalized, it is natural to believe that few corporations face a competitive threat from competitors utilizing the technology. When the technology is adopted and tested at a larger scale, it would be natural to assume that *organizational factors* could play a role in adoption, as they have previously done in research related to technology adoption.

8.4 Limitations

The biggest limitations to the research are the convenience method of sampling used, which reduces generalizability of the results. There is a significant risk of a homogenous population, and it may also be biased (Etikan et al., 20176We recognize this as a clear limitation to our research, as we have chosen participants who have some experience with technology, and who were also easy for us to reach. We recognize from the demographics overview in Table 1, that we surveyed mostly male participants, and a majority of junior level employees. The reasons for this are most likely the extent of our own professional network. We used LinkedIn, a social media-platform for professional connections, to reach out to potential respondents. Many of the connections in our respective professional networks are at the beginning of their career, and many of them are also likely to have rather low knowledge of Blockchain technology. This weakens the generalizability of the research, and has to be accounted for in future research. For instance, variables such as *subjective norm* may have an even bigger influence in less experienced and more mature samples.

Secondly, the size of the sample has implications for external validity and generalizability. Even though the statistical outputs indicate good fit and significant findings, the results would be more applicable with a larger sample size.

When it comes to applying the TAM framework to technology adoption, there are certain known limitations. We previously discussed some of these limitations in chapter 3.3.1, however we find it necessary to compare some of these to what we experience in our own research. For instance, Yousafzai (2007) voices concerns regarding the self-reporting during TAM data collection, instead of measuring actual usage, in real-life settings or experiments. This might make results more subjective, and the output may yield more subjective results. As we have not compared our own research to other types of research design, it is hard to compare, but we see a clear possibility that individuals might overestimate their likelihood to take use of Blockchain technology, or credit themselves with too much experience with the technology.

Furthermore, we are measuring *intention*, essentially saying that *intention* equals actual *usage*. Bagozzi (2007) argued that the empirical evidence for this was weak, which in time weakened the theoretical framework of the TAM. The dissonance between *intention* and *usage* might be a factor that limits the value of our results. Bagozzi (2007) further argues that the time between *intention* and actual *usage* is prone to uncertainty. Essentially meaning a delay in time between *intention* to use, and *actual use*, might alter the results. In the case of Blockchain, the technology has yet to be operationalized at a large scale, and general adoption is most likely years off, essentially supporting uncertainty for our results.

Our study is limited by time and resources, and we believe a more comprehensive study would give more generalizable results, for instance, including more external factors in the TAM framework, such as *perceived risk*, would perhaps result in a higher explanation of the variance. Furthermore, a larger sample, based on a probabilistic sampling would yield results that are easier to generalize.

8.5 Future Research

When it comes to future research the goal should be to explain more of the variance when it comes to the usage *intention* of Blockchain technology both in Norway and abroad. As this thesis is not able to explain more than approximately half of the variance, there is a substantial potential for future research regarding adoption of Blockchain technology.

The research model analyzed, contained five antecedents plus two control variables, and their effect on usage *intention*. For future research it is recommended to expand the framework with other variables. This will most likely improve the percentage of variance explained, and as a result broaden the understanding and knowledge regarding the factors affecting the adoption of Blockchain technology. Since our research was unsuccessful in finding significant organizational factors, future studies could look more into the organizational effects on adoption, and find relevant factors to measure. As organizational structure, workings and elements affect the day-today activity in companies, it is reasonable to assume that there are several significant factors that could be researched.

Regarding the TAM framework, future studies is suggested to consider *perceived ease of use* and its effect on usage *intention*. With a bigger or a different demographic sample there might be substantial changes in the significant factors, and we assume that *perceived ease of use* has more real-life effect on adoption than we were able to measure in our research. As this study mainly obtained and analyzed responses from young and junior-level respondents, future research should also include older and more senior respondents. We believe this will result in other significant factors, and more generalizable results. In addition, it is suggested to look into other industries or focus more on specific industries. As there are a lot of different use cases and applications for Blockchain technology, it is interesting to look into other or specific industries to find the unique and significant factors towards adoption.

This study is also limited to Norwegian corporations, and future research could look into other sample countries to identify differences and similarities regarding Blockchain technology adoption. We believe that a difference in corporate cultures and business law and regulations will result in different underlying factors regarding adoption.

As Blockchain technology is maturing as a technology, the fundaments for adoption is assumed to change during this development. Future research regarding Blockchain technology adoption is needed and exciting.

9. Conclusion

The research model in this thesis shows a good fit, and explanation of almost half of the variance (45.7 %) in the intention to use Blockchain technology in Norwegian corporations. We are careful in drawing concrete conclusions from this, however, we believe that this research is a good framework for future studies within the field of adoption of this new technology. The model used in this thesis explains a higher variance than some of the previous uses of the TAM framework, and may be interesting as a foundation for future research on adoption of new technologies. Furthermore, the model is inspired and built on top of traditional models for adoption of Internet technologies, meaning that it could provide a good framework for future technologies that are either built on top of the Internet, or has similarities to Internet technology.

Blockchain technology may prove to be a significant shift in the technology used to structure supply chains, and has already impacted the global financial industry. At the time of writing, news has just surfaced that Bitcoin and Blockchain may be one of the upcoming topics of the 2018 G-20 summit (Higgins, 2017). This entails that the technology is starting to show significant impact on global politics, and there is reason to believe that there will be implications on private corporations in the near future. Failure to recognize the important to adopting this new technology may lead to losses in competitive situations, however, the results of this thesis do not discuss these aspects. Finally, the results from our study indicates the importance of educating and exposing the employees of corporations to the potential benefits of Blockchain technology, if one wishes to adopt it.

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Appendix A. Factor Loadings

Pattern Matrix[a]

	Factor					
	1	2	3	4	5	6
Ease of use - Learning to use Blockchain technology is easy to me	-.062	.108	.103	.720	.068	-.021
Ease of use - It is easy to make Blockchain technology do what i want it to do	.183	.064	-.005	.693	.054	-.050
Ease of use - It is easy to use Blockchain technology	.101	-.087	.047	.894	.041	-.014
Ease of use - Interacting with Blockchain technology does not require a lot of my mental effort	-.082	-.045	-.053	.653	-.060	.060
Usefulness - Using Blockchain technology makes me save time	.922	.051	-.013	.042	-.097	.080
Usefulness - Using Blockchain technology improves my efficiency	.996	-.019	.053	.010	-.008	-.093
Usefulness - Blockchain technology is useful to me	.511	-.029	.012	-.008	.346	.091
Usefulness - Using Blockchain technology in my job would enable me to accomplish tasks more quickly	.355	.255	.099	.114	.103	-.045
Subjective norms - People important to me think i should use Blockchain technology	.029	.003	.024	.098	.752	-.050
Subjective norms - It is expected that people like me use Blockchain technology	-.004	.091	.080	-.042	.768	.081

Subjective norms - People i look up to expect me to use Blockchain technology	-.055	.050	-.027	-.020	.824	.097
Competitive environment - Our competitors are adopting Blockchain technology which gives our company pressure to adopt it too as they can perform their tasks efficiently by adopting it	.061	-.074	.911	.013	-.002	.076
Competitive environment - Our key competitors get many advantages through adopting Blockchain technology	.045	-.039	.870	-.006	.042	-.058
Competitive environment - We are aware of our competitors who have adopted Blockchain technology which is perceived favorably by others in our industry	-.097	.124	.727	.055	.034	-.008
Competitive environment - Many of our competitors are going to adopt Blockchain technology in the near future	-.015	.013	.746	-.022	-.059	.081
Management support - Top management in my organization deems Blockchain technology to be essential in the operations of the company	.072	.110	.189	-.006	.192	.491
Management support - The decision of top management in my organization is vital for the company to adopt Blockchain technology	.225	.100	.105	.000	-.018	.522

Management support - Management in my organization is aware of the benefits that can be achieved with the use of Blockchain technology	-.082	-.083	.056	-.007	.090	.552
Management support - Top management in my organization will support Blockchain technology adoption	-.010	.087	-.009	.041	-.018	.705
Intention - I intend to use Blockchain technology in the near future	.000	.921	.027	-.035	-.029	.100
Intention - I plan to use Blockchain technology in the near future	.035	.906	-.060	-.013	.031	.093
Intention - I expect to use Blockchain technology in the near future	-.032	.895	.081	.038	.098	-.128

Extraction Method: Maximum Likelihood.

Rotation Method: Oblimin with Kaiser Normalization.[a]

a. Rotation converged in 9 iterations.

Pattern Matrix[b]

	Factor					
	1	2	3	4	5	6
Ease of use - Learning to use Blockchain technology is easy to me	-.055	.111	.101	.721	.069	-.022
Ease of use - It is easy to make Blockchain technology do what i want it to do	.184	.069	-.004	.693	.067	-.054
Ease of use - It is easy to use Blockchain technology	.105	-.076	.060	.884	.036	-.022
Ease of use - Interacting with Blockchain technology does not require a lot of my mental effort	-.079	-.041	-.053	.653	-.060	.063
Usefulness - Using Blockchain technology makes me save time	.909	.047	-.023	.039	-.030	.088
Usefulness - Using Blockchain technology improves my efficiency	.983	-.026	.042	.004	.063	-.085
Subjective norms - People important to me think i should use Blockchain technology	.043	-.017	.007	.088	.770	-.057
Subjective norms - It is expected that people like me use Blockchain technology	.010	.063	.058	-.053	.805	.068
Subjective norms - People i look up to expect me to use Blockchain technology	-.040	.028	-.045	-.030	.843	.086
Competitive environment - Our competitors are adopting Blockchain technology which gives our company pressure to adopt it too as they can perform their tasks efficiently by adopting it	.063	-.070	.902	.015	.006	.080

Competitive environment - Our key competitors get many advantages through adopting Blockchain technology	.046	-.033	.872	-.006	.040	-.064
Competitive environment - We are aware of our competitors who have adopted Blockchain technology which is perceived favorably by others in our industry	-.094	.129	.725	.059	.033	-.014
Competitive environment - Many of our competitors are going to adopt Blockchain technology in the near future	-.014	.017	.739	-.018	-.053	.084
Management support - Top management in my organization deems Blockchain technology to be essential in the operations of the company	.074	.105	.186	-.009	.212	.477
Management support - The decision of top management in my organization is vital for the company to adopt Blockchain technology	.222	.104	.112	-.004	-.005	.511
Management support - Management in my organization is aware of the benefits that can be achieved with the use of Blockchain technology	-.078	-.087	.050	-.008	.097	.555
Management support - Top management in my organization will support Blockchain technology adoption	-.008	.086	-.008	.041	-.012	.702

Intention - I intend to use Blockchain technology in the near future	.005	.920	.026	-.027	-.029	.090
Intention - I plan to use Blockchain technology in the near future	.038	.911	-.058	-.005	.030	.078
Intention - I expect to use Blockchain technology in the near future	-.024	.896	.082	.045	.090	-.141

Extraction Method: Maximum Likelihood.

Rotation Method: Oblimin with Kaiser Normalization.[a]

a. Rotation converged in 9 iterations.

Appendix B. Total Variance Explained, Eigenvalues and Cronbach's alpha

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.412	37.059	37.059	2.994	14.968	14.968	2.880
2	2.592	12.962	50.021	5.481	27.403	42.371	4.633
3	1.844	9.220	59.241	1.993	9.964	52.335	5.265
4	1.577	7.886	67.127	1.834	9.168	61.502	2.949
5	1.248	6.238	73.365	1.020	5.100	66.603	4.697
6	1.041	5.207	78.573	.699	3.493	70.095	3.317
7	.647	3.235	81.808				
8	.628	3.140	84.948				
9	.514	2.572	87.520				
10	.486	2.429	89.950				
11	.427	2.136	92.085				
12	.348	1.741	93.826				
13	.293	1.463	95.289				
14	.210	1.048	96.338				
15	.203	1.013	97.351				
16	.156	.780	98.131				
17	.114	.568	98.699				
18	.109	.545	99.245				
19	.089	.443	99.688				
20	.062	.312	100.000				

Extraction Method: Maximum Likelihood.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

PEoU - Reliability Statistics

Cronbach's Alpha	N of Items
.843	4

PU - Reliability Statistics

Cronbach's Alpha	N of Items
.956	2

SN - Reliability Statistics

Cronbach's Alpha	N of Items
.873	3

CE - Reliability Statistics

Cronbach's Alpha	N of Items
.900	4

MS - Reliability Statistics

Cronbach's Alpha	N of Items
.760	4

I - Reliability Statistics

Cronbach's Alpha	N of Items
.954	3

Appendix C. Correlation Matrix

Correlations

		PEOU	PU	SN	CE	MS	PI	Knowledge and Experience - I feel that i have in-depth knowledge of Blockchain technology	Knowledge and Experience - I feel that i have in-depth experience of Blockchain technology
PEOU	Pearson Correlation	1	.295**	.272**	.290**	.127	.202*	.058	.098
	Sig. (2-tailed)		.003	.006	.003	.202	.042	.566	.326
	N	102	102	102	102	102	102	102	102
PU	Pearson Correlation	.295**	1	.251*	.285**	.223*	.314**	.012	.109
	Sig. (2-tailed)	.003		.011	.004	.024	.001	.907	.276
	N	102	102	102	102	102	102	102	102
SN	Pearson Correlation	.272**	.251*	1	.484**	.509**	.532**	.325**	.420**
	Sig. (2-tailed)	.006	.011		.000	.000	.000	.001	.000
	N	102	102	102	102	102	102	102	102
CE	Pearson Correlation	.290**	.285**	.484**	1	.586**	.453**	.215*	.292**
	Sig. (2-tailed)	.003	.004	.000		.000	.000	.030	.003
	N	102	102	102	102	102	102	102	102
MS	Pearson Correlation	.127	.223*	.509**	.586**	1	.432**	.264**	.340**
	Sig. (2-tailed)	.202	.024	.000	.000		.000	.007	.000
	N	102	102	102	102	102	102	102	102
PI	Pearson Correlation	.202*	.314**	.532**	.453**	.432**	1	.449**	.577**
	Sig. (2-tailed)	.042	.001	.000	.000	.000		.000	.000
	N	102	102	102	102	102	102	102	102

Knowledge and Experience - I feel that i have in-depth knowledge of Blockchain technology	Pearson Correlation	.058	.012	.325**	.215*	.264**	.449**	1	.764**
	Sig. (2-tailed)	.566	.907	.001	.030	.007	.000		.000
	N	102	102	102	102	102	102	102	102
Knowledge and Experience - I feel that i have in-depth experience of Blockchain technology	Pearson Correlation	.098	.109	.420**	.292**	.340**	.577**	.764**	1
	Sig. (2-tailed)	.326	.276	.000	.003	.000	.000	.000	
	N	102	102	102	102	102	102	102	102

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix D. Descriptives and Normality Indicators

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PEOU	102	1.00	5.75	3.3799	1.03988	-.309	.239	-.473	.474
PU	102	1.00	6.50	4.0637	1.17665	-.514	.239	.820	.474
SN	102	1.00	7.00	3.5915	1.49506	.108	.239	-.742	.474
CE	102	1.00	7.00	3.8309	1.43901	-.050	.239	-.797	.474
MS	102	1.00	7.00	4.3971	1.25092	-.096	.239	-.484	.474
PI	102	1.00	7.00	4.2582	1.65966	-.107	.239	-.969	.474
Knowledge and Experience - I feel that i have in-depth knowledge of Blockchain technology	102	1	7	3.13	1.912	.508	.239	-1.008	.474
Knowledge and Experience - I feel that i have in-depth experience of Blockchain technology	102	1	7	2.27	1.562	1.281	.239	.802	.474
Valid N (listwise)	102								

Appendix E. Regression Output

Excluding control variables

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.602[a]	.363	.330	1.35882

a. Predictors: (Constant), MS, PEOU, PU, SN, CE

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	100.949	5	20.190	10.935	.000[b]
	Residual	177.253	96	1.846		
	Total	278.202	101			

a. Dependent Variable: PI

b. Predictors: (Constant), MS, PEOU, PU, SN, CE

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.555	.684		.811	.419		
	PEOU	-.005	.142	-.003	-.038	.970	.839	1.191
	PU	.214	.124	.152	1.724	.088	.858	1.166
	SN	.390	.111	.351	3.506	.001	.661	1.513
	CE	.197	.124	.171	1.589	.115	.574	1.742
	MS	.159	.142	.120	1.118	.266	.581	1.721

a. Dependent Variable: PI

Including control variables

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.703[a]	.494	.457	1.22351

a. Predictors: (Constant), Knowledge and Experience - I feel that i have in-depth experience of Blockchain technology, PEOU, PU, MS, SN, CE, Knowledge and Experience - I feel that i have in-depth knowledge of Blockchain technology

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	137.487	7	19.641	13.120	.000[b]
	Residual	140.715	94	1.497		
	Total	278.202	101			

a. Dependent Variable: PI

b. Predictors: (Constant), Knowledge and Experience - I feel that i have in-depth experience of Blockchain technology, PEOU, PU, MS, SN, CE, Knowledge and Experience - I feel that i have in-depth knowledge of Blockchain technology

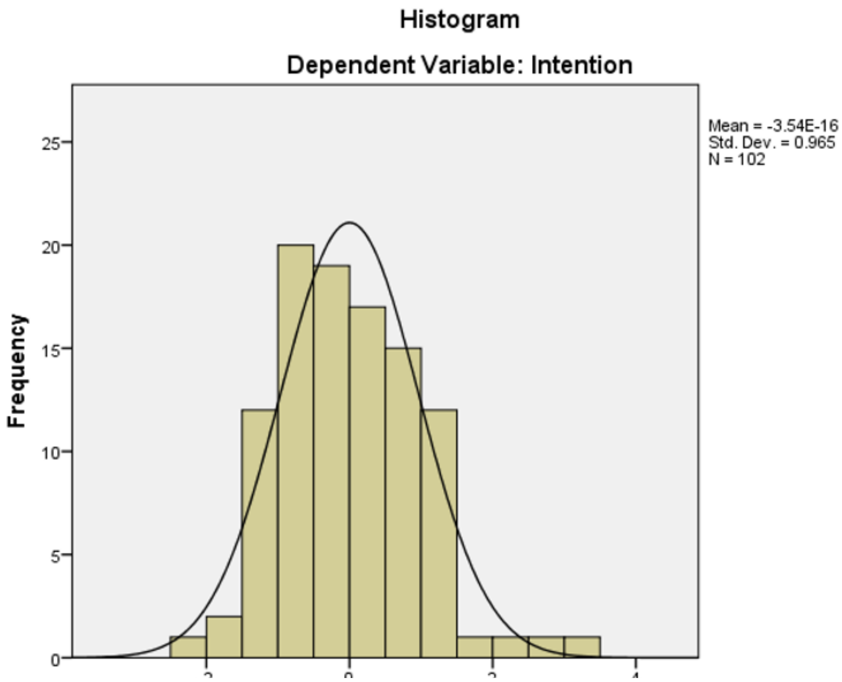
Coefficients[a]

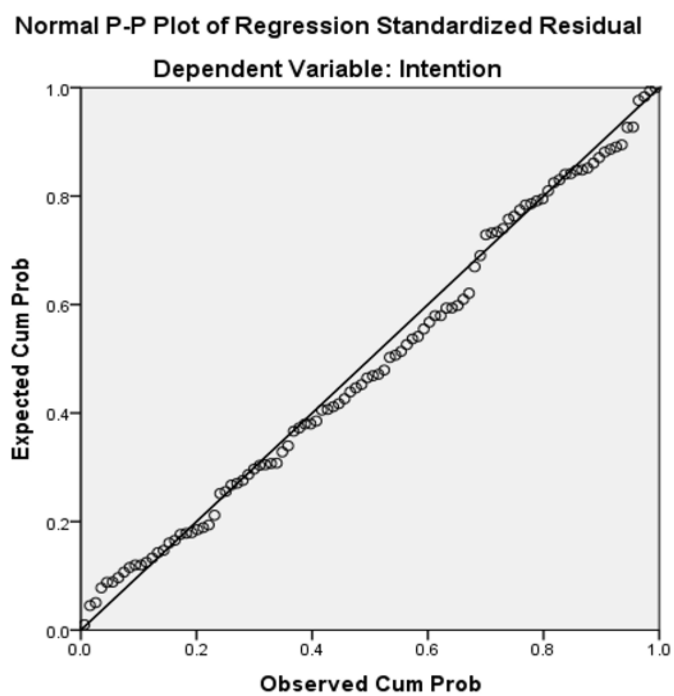
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.412	.631		.654	.515		
	PEOU	.009	.128	.005	.068	.946	.839	1.192
	PU	.228	.112	.162	2.031	.045	.847	1.181
	SN	.242	.105	.218	2.314	.023	.607	1.648
	CE	.170	.112	.147	1.518	.132	.573	1.747
	MS	.080	.129	.060	.620	.537	.572	1.748

	Knowledge and Experience - I feel that i have in-depth knowledge of Blockchain technology	.041	.099	.048	.416	.679	.411	2.436
	Knowledge and Experience - I feel that i have in-depth experience of Blockchain technology	.391	.127	.368	3.075	.003	.376	2.658

a. Dependent Variable: PI

Appendix F. Linear Regression Plots





Appendix G. Survey

NHH

Survey introduction.

Thank you for agreeing to take part in this survey. This is a part of our master thesis work at the Norwegian School of Economics regarding Blockchain technology in Norwegian corporations. The survey consists of 28 questions and all responses are anonymized.

Some of the questions could be perceived as similar, but this is a consequence of research-related considerations. The entire scale can be used. It is voluntary to participate in this survey, and it can be canceled at any time. There are no right or wrong answers, and we value your true opinion.

Below is a short introduction to Blockchain technology:

"Blockchains are a ledger that keeps track of data and the owners of the data. One can use a blockchain to transact data between any connected participant using the blockchain and all participants have the most up to date version of that ledger, ensuring everyone is constantly up to date with the latest. Usually one needs to trust some third party to maintain records of events, but blockchains enable you to transact with people you don't trust and yet still ensure that their inputs into the blockchain are true. Complex cryptography ensures nobody can falsify a record to try to include data which the other participants haven't seen or agreed to. Blockchains are open for anyone to track the provenance of the data and simple to audit with no single point of failure by design" - George Harrap, founder of Bitspark.io

Based on this explanation by George Harrap and other knowledge and experience you may have with Blockchain technology, please answer the following questions.

0% 100%

1. Which industry do you belong to?

- Consulting
- Banking/Finance
- IT/Tech
- Insurance
- Industry/Retail
- Other

2. Which position do you currently have?

- Entry level/Junior
- Senior
- Manager
- Partner/Management
- Other

0% 100%

3. Ease of use

	1. Strongly disagree	2. Disagree	3. Somewhat disagree	4. Neither agree or disagree	5. Somewhat agree	6. Agree	7. Strongly agree
Learning to use Blockchain technology is easy to me	○	○	○	○	○	○	○
It is easy to make Blockchain technology do what i want it to do	○	○	○	○	○	○	○
It is easy to use Blockchain technology	○	○	○	○	○	○	○
Interacting with Blockchain technology does not require a lot of my mental effort	○	○	○	○	○	○	○

0% 100%

4. Usefulness

	1. Strongly disagree	2. Disagree	3. Somewhat disagree	4. Neither agree or disagree	5. Somewhat agree	6. Agree	7. Strongly agree
Using Blockchain technology makes me save time	○	○	○	○	○	○	○
Using Blockchain technology improves my efficiency	○	○	○	○	○	○	○
Blockchain technology is useful to me	○	○	○	○	○	○	○
Using Blockchain technology in my job would enable me to accomplish tasks more quickly	○	○	○	○	○	○	○

0% 100%

5. Subjective norms

	1. Strongly disagree	2. Disagree	3. Somewhat disagree	4. Neither agree or disagree	5. Somewhat agree	6. Agree	7. Strongly agree
People important to me think i should use Blockchain technology	○	○	○	○	○	○	○
It is expected that people like me use Blockchain technology	○	○	○	○	○	○	○
People i look up to expect me to use Blockchain technology	○	○	○	○	○	○	○

0% 100%

6. Competitive environment

	1. Strongly disagree	2. Disagree	3. Somewhat disagree	4. Neither agree or disagree	5. Somewhat agree	6. Agree	7. Strongly agree
Our competitors are adopting Blockchain technology which gives our company pressure to adopt it too as they can perform their tasks efficiently by adopting it	○	○	○	○	○	○	○
Our key competitors get many advantages through adopting Blockchain technology	○	○	○	○	○	○	○
We are aware of our competitors who have adopted Blockchain technology which is perceived favorably by others in our industry	○	○	○	○	○	○	○
Many of our competitors are going to adopt Blockchain technology in the near future	○	○	○	○	○	○	○

0% 100%

← →

7. Management support

	1. Strongly disagree	2. Disagree	3. Somewhat disagree	4. Neither agree or disagree	5. Somewhat agree	6. Agree	7. Strongly agree
Top management in my organization deems Blockchain technology to be essential in the operations of the company	○	○	○	○	○	○	○
The decision of top management in my organization is vital for the company to adopt Blockchain technology	○	○	○	○	○	○	○
Management in my organization is aware of the benefits that can be achieved with the use of Blockchain technology	○	○	○	○	○	○	○
Top management in my organization will support Blockchain technology adoption	○	○	○	○	○	○	○

0% 100%

← →

8. Intention

	1. Strongly disagree	2. Disagree	3. Somewhat disagree	4. Neither agree or disagree	5. Somewhat agree	6. Agree	7. Strongly agree
I intend to use Blockchain technology in the near future	○	○	○	○	○	○	○
I plan to use Blockchain technology in the near future	○	○	○	○	○	○	○
I expect to use Blockchain technology in the near future	○	○	○	○	○	○	○

0% 100%

← →

9. Knowledge and Experience

	1. Strongly disagree	2. Disagree	3. Somewhat disagree	4. Neither agree or disagree	5. Somewhat agree	6. Agree	7. Strongly agree
I feel that i have in-depth knowledge of Blockchain technology	○	○	○	○	○	○	○
I feel that i have in-depth experience of Blockchain technology	○	○	○	○	○	○	○

0% 100%

10. Gender

- Male
- Female

0% 100%

11. Age

- 18-24
- 25-39
- 40-54
- 55-69
- 70+

0% 100%

We thank you for your time spent taking this survey.
Your response has been recorded.

0% 100%