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# A study on blockchain technology as a resource for competitive advantage.

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*"You are my proof-of-work consensus algorithm. To you, Mariabeib."*

- Magnus V. Bjørnstad

*"Home is where my heart is - to my homegirl Anna".*

- Joar G. Harkestad

*"To the source of my competitive advantage, Valentina".*

- Simen A. Krogh

# Abstract

The blockchain innovation is still in its nascent stage, but among its characteristics is the potential to eliminate the need for third parties to act as a level of trust. In a literature review, it was found that the link between application areas and entrepreneurial opportunities were superficially covered for blockchain technology (Bjørnstad et al., 2016). This thesis seeks to understand the technology as a resource to investigate how blockchain, together with other resources, contributes to the competitiveness of the firm. A theoretical framework has been developed with a resource-based view to analyze empirical data collected through a qualitative study on four blockchain companies.

Our findings show that the blockchain technology is interconnected with other resources. Employee know-how is found to be the most scarce and valuable resource, and founders with extensive prior experience with blockchain are more likely to create valuable blockchain solutions. Important external resources contributing to a competitive advantage are found to be community building and strategic partnerships.

Our analysis shows that competitiveness of blockchain as a resource is reflected through the process of choosing the technology. The approaches for utilising blockchain are found to be technology first - problem second, or problem first - technology second. We have found that visionary founders with extensive prior experience with blockchain tend to start out with problems that needs a technology like blockchain in order to be solved. This process is found to give more valuable solutions than starting with technology first.

This study contributes by bridging the identified knowledge gap between potential application areas of blockchain, and the necessary resource configuration enabling a firm to utilize blockchain as a resource for that application area. By applying our framework to analyze how companies are utilising blockchain, together with other resources, for competitiveness, we demonstrate the relevance of the resource configurations.

# Sammendrag

Blockchain er fremdeles i en tidlig fase, men blant teknologiens egenskaper er potensialet for å eliminere behovet for tredjeparter til å fungere som tillitsledd. I en 'literature review' ble det funnet at blockchain-teknologien er overfladisk dekket når det kommer til koblingen mellom applikasjonsområder og entreprenørielle muligheter (Bjørnstad et al., 2016). Denne studien søker å forstå teknologien som en ressurs for å undersøke hvordan blockchain, sammen med andre ressurser, bidrar til selskapets konkurranseevne. Et teoretisk rammeverk er utviklet med et 'resource-based view' for å analysere empiriske data samlet inn gjennom en kvalitativ studie på fire blockchain-selskaper.

Våre funn viser at blockchain-teknologien er tett koblet opp mot andre ressurser. Ansattes 'know-how' er funnet å være den mest verdifulle ressursen, og entreprenører med mye tidligere erfaring med blockchain har mer sannsynlighet for å skape verdifulle blockchain-løsninger. Viktige eksterne ressurser som bidrar til konkurransefortrinn, er funnet å være bygging av 'community' og strategiske partnerskap.

Blockchain-ressursens konkurranseevne er funnet å reflekteres gjennom prosessen med å velge teknologien. Tilnærmingene for bruk av blockchain er funnet å være teknologi først - problem i andre rekke, eller problem først - teknologi i andre rekke. Vi har funnet ut at visjonære grunnleggere med mye tidligere erfaring med blockchain har en tendens til å starte med problemer som trenger en teknologi som blockchain for å bli løst. Denne prosessen er funnet å gi mer verdifulle løsninger enn når man tar utgangspunkt i teknologien.

Denne studien bidrar til å bygge bro over det identifiserte kunnskapsgapet mellom potensielle bruksområder for blockchain og den nødvendige ressurskonfigurasjonen som gjør det mulig for et firma å benytte blockchain som ressurs for det aktuelle applikasjonsområdet. Ved å bruke rammeverket vårt for å analysere hvordan selskaper bruker blockchain, sammen med andre ressurser, for å øke egen konkurranseevne, demonstrerer vi i denne oppgaven relevansen av ressurskonfigurasjonene til selskapene.

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# 1 Introduction

Blockchain is a distributed ledger technology that acts as a shared database, keeping all of its copies synced and verified. The blockchain innovation is still in its nascent stage, but among its characteristics is the potential to eliminate the need for third parties to act as a level of trust in exchange of data - referred to as transactions. This is one of the roots of the many indications that the technology could impact business models across industries substantially (Seppälä, 2016). However, in the hype and numerous predictions about the potential of this emerging technology, the authors of this thesis have found a shortcoming in the theory associated with what value blockchain technology can bring a company and its users from an entrepreneurial perspective.

This research focuses on analyzing how and why blockchain is being used to solve problems by companies, and the underlying processes of choosing blockchain as the technology best fitted to solve a specific problem. With this we wish to provide insights on how to consider blockchain technology from a strategic perspective for companies interested in utilizing the technology.

This introductory chapter contains an introduction to blockchain as a concept and how it is covered in the literature. Then follows an elaboration for the foundation of the thesis and explanation of why we are investigating the chosen aspect of blockchain technology and entrepreneurship. Further, the purpose of the research is presented, followed by the associated research questions. The contribution of this study and structure of the master's thesis is presented at the end of the chapter.

## 1.1 Technology at focus: blockchain

Today banks keep track of all parties' balances in a ledger that is closed off to the public. We rely on banks to confirm or reject transactions. The bank checks the balances of the trading parties in the ledger and updates it whenever a transaction has occurred. This is a system with a centralized authority - the bank. Blockchain is the opposite - essentially a system with

distributed authority amongst users that enables them to trade digital assets (Nakamoto, 2012). The authority is distributed by having a public ledger that every user of the system can check (ibid), and the system is a growing list of ordered records of transactions (Allen, 2016). Whenever a trade is engaged, involved parties checks if the transacting party has the minimum balance to complete the trade and updates the public ledger if the criteria were met (ibid).

### 1.1.1 Characteristics of blockchain

Allen (2016) emphasizes that it is important to note that the blockchain technology underpinning Bitcoin does not need to store information over currency. Any type of information that requires a third party intermediary for verification can theoretically be stored in a blockchain to make it independent of this intermediary (ibid). In this view, Mougayar (2016) builds on the points Allen (2016) makes, and defines blockchain more broadly as a "value exchange network", holding the potential to store and transmit information in a decentralised way.

Zhu and Zhou (2017) formulate characteristics of blockchain in regards of analyzing blockchain applications within the Chinese equity crowdfunding market in the 2017 journal Financial Innovations. We have summarized Zhu and Zhou's (2017) paper on characteristics of blockchain in table 1.1 below.

**Table 1.1:** Characteristics of blockchain technology based on Zhu and Zhou's (2017) paper in 2017 journal; Financial Innovations

| Characteristics | Explanation |
|---|---|
| Distributed ledger and transparency | A shared public list of transactions (the exchange of data) allows every peer in the network to have access to every transaction made, making the system transparent. |
| Decentralized data management | Every peer in the system has the authority to add data to the ledger, in other words make transactions. Meaning no one user owns the system more than any other. |
| Data security, tamper-proof, anti-forgery and data integrity | Blockchain is architectured to store data such that it is immutable and tamper-proof. The decentralized nature of blockchain makes it overly challenging to take advantage of the system by ill-intentioned users. |
| High efficiency | Checking balances and completing transactions in a blockchain system can, in theory, be instantaneous. |
| No risk of centralized failure | The lack of a centralized storage system removes the risk of losing data and downtime due to problems with a centralized unit. |
| Flexible and reliable | Blockchains programmable features increase flexibility and reliability in different application scenarios. |

### 1.1.2 Applications of blockchain

The hype and low level of understanding around blockchain technology are the main reasons it is being introduced to many problems it fits poorly, or not at all (Seppälä, 2016). This is exemplified by Gartner (2016), who reports blockchain being close to the peak of the hype cycle for emerging technologies, indicating that the expectations of the technology are currently exaggerated (Rizzo, 2016). This often leaves the market with a high number of startup companies with hypothetical use cases that use the increasing amount of hype for their marketing benefit (Linden and Fenn, 2003). Here we will give an introduction to what the literature says about the application areas and how they are categorized today.

When it comes to the specific application areas, we have not found a consensus in the literature as to which areas are the definitive best use cases for blockchain technology, except for the obvious use case of currency, as seen with Bitcoin. There are many that aim to map out and list the possible use cases and applications for blockchain, although the possibilities of the technology are barely explored (Tschorsch and Scheuermann, 2016). Atzori (2015) states there are "potentially countless" applications of the blockchain underlying paradigm.

P2P Foundation on the other hand has a list of applications actually using the blockchain technology today, at the time consisting of 33 applications (Soo, 2016). Even though the lists of application areas may seem very different, there is a general consensus around what are the most prominent application areas based on today's use of blockchain. Dividing the application areas is usually done into four categories.

While Ledra Capital (2014) and P2P Foundation (Soo, 2016) write lists of potential and current applications, not elaborating on them, the organization Blockchain Technologies (2016) divide the applications into the four most commonly agreed upon categories, and further expand them with subcategories creating an ordered list of application areas. The four main categories are shown in table 1.2.

**Table 1.2:** Blockchain Technologies' (2016) division of blockchain technology applications

| Applications | Involves | Explanation |
|---|---|---|
| Finance | Distributed ledger and financial services | Main focus on the original and first-proven application of blockchain - Bitcoin, or alternatively that financial institutions create their own private blockchains |
| Property | Smart, Autonomous Property | Smart property allows ownership of both physical and non-physical property to be verified, programmable and tradeable on the blockchain. Physical examples of smart property include vehicles, phones and houses which can be activated, deactivated, tracked, and maintained. |
| Law | Programmable and Self-executing Contracts | Discusses the concept of Decentralized Autonomous Corporations (DAC), Decentralized Autonomous Organizations (DAO), empowering of artists to extend their ownership of their works, and blockchain real estate allowing for an unparalleled upgrade in how records are stored and recorded. |
| Identity | Safe and Secure Identity Verification | Introduces the concept of blockchain identity applications allowing unaltered identity verification, authorization and management, resulting in significant efficiencies and reduced fraud. |

In her book "Blockchain: Blueprint for a New Economy", Swan (2015) chooses to divide the development and applications of blockchain into the following three main categories based on the stages of the technology in table 1.3:

**Table 1.3:** Swan's (2015) division of development stages of blockchain

| Type | Description | Examples |
|---|---|---|
| Blockchain 1.0 | Currency | Cryptocurrencies like Bitcoin. Was first introduced in 2009. |
| Blockchain 2.0 | Contracts | Financial services, crowdfunding, Bitcoin prediction markets, smart property, smart contracts. Was introduced through the release of NXT in 2013. |
| Blockchain 3.0 | Justice, efficiency and coordination applications beyond currency, economics, and markets | Digital Identity, Intellectual Property Protection, Governance Services, Elections. Solutions within these areas of applications are starting to take form. |

This division of the technology is done by the expected development. As the technology develops, more and more features are integrated into it, and the application areas are expanded. We found that this is the most agreed upon model for categorising blockchain based on developmental stage, between researchers. The grouping of the application areas differ within these categories, but there is a consensus for using these three main categories to group the technology and use-case development.

## 1.2 Foundation for the thesis

Through a comprehensive literature review by the authors (Bjørnstad et al., 2016), the theoretical coverage of blockchain and its application areas was mapped. Prior to this review, there had been performed systematic literature reviews on blockchain from a technical side (Yli-Huumo et al., 2016), but to the authors' knowledge this had not been done for the business aspect of blockchain technology at the time of writing.

### 1.2.1 Literature review and identified gap in the literature

The literature review performed prior to this study gives an understanding of the concept of blockchain technology, how the application areas are covered in the literature, and the distribution of publications within identified topics. The review shows that the following topics lacks in-depth coverage; blockchain as governance technology, smart contracts, business models, entrepreneurial opportunities and challenges, and blockchain as a general purpose technology. The way the areas lack coverage is through concrete case studies of companies utilising blockchain, investigating the value of the technology (Bjørnstad et al.,

2016). The authors therefore see the blockchain literature, generally, being of a predictive nature, where the potential opportunities of the technology are widely covered, but the discussion on how blockchain can contribute to create value within companies is still lacking. The focus is on what could happen if blockchain is adopted by the masses, and underlying potential use cases, without going into value creating processes of blockchain. We will rather investigate the reasoning for choosing to use blockchain technology to solve a problem and what value the technology adds for the companies utilising it.

We have found that Allen (2016) also addresses a lack of articles going in-depth on the blockchain application areas' implications for entrepreneurs in his description of the entrepreneurial aspects surrounding the emerging crypto economy. "While the underlying technical invention of blockchain has been available since 2009, applicable entrepreneurial opportunities remain nascent" (Allen, 2016, p.1). "The entrepreneurial problem of the blockchain is a development problem - analogous to that in new development economics - requiring non-price coordination over the complementarity of applications and opportunities" (ibid). His views are shared by Davidson et al. (2016), who agrees on the potentially disruptive capabilities of blockchain and also the underlying challenges for entrepreneurs in the blockchain domain.

Based on our discovery of a lack of literature and discussion on the entrepreneurial aspects of value creation for blockchain companies, the authors will perform a case study on companies utilising blockchain technology to investigate the reasoning for choosing blockchain technology, and what value the technology provides.

## 1.3 Purpose of the study

Blockchain was released as Bitcoin in 2009 and followingly has not had the chance to be thoroughly explored through entrepreneurial attempts, nor had the chance to be written extensively about. Yet there are numerous companies utilizing blockchain technology, and it is getting increasingly more attention from experts, press and investors. Most of the literature available on blockchain is somewhat of a technical degree focusing more on developing the technology, cryptography and possible application areas. Many articles address different

application areas for blockchain technologies, but without discussing the underlying reasoning for choosing blockchain. This makes it difficult to understand the value of blockchain and why one should prefer a decentralized approach (which blockchain essentially is) over other solutions that in many instances can be described as centralized. We will therefore investigate the reasoning for choosing blockchain technology and the value added from that solution in different companies building services utilizing blockchain technology. Hence, the following purpose has been outlined:

"To investigate how blockchain, together with other resources, contributes to the competitiveness of the firm"

The competitiveness of the firm is viewed as the firm's configuration of resources, how they are utilised, and if they serve as a foundation for competitive advantage. We will be investigating the process prior choosing to use blockchain technology to solve a problem or satisfy a need, and what value the technology adds to the companies utilising it and its customers. With the gathered information, the authors will gain insight in what entrepreneurs currently use blockchain technology for, what value it adds, and the reasoning for choosing that technology to solve a problem. Furthermore, the authors will use the analyzed data to compare each case to identify commonalities between them to further highlight the value blockchain contributes to. The goal is to discover concrete factors that makes blockchain a valuable and competitive resource.

The outlined purpose of the study is broad and does not explicitly exclude any aspects of the blockchain technology, and one can therefore expect to see an investigation of the technical aspects of developing the technology and a presentation of the details of the source code. This, however, is not addressed in the study - so the purpose does not cover the product development nor the programming aspects of the technology.

## 1.4 Research questions

We seek to understand value adding through utilizing the blockchain technology and its advantages, which includes investigating underlying processes of choosing blockchain. To be able to investigate the value of blockchain, it is necessary to understand how the technology functions as a resource. The authors will focus on a resource as an asset, capability, information or knowledge owned by the company, that "enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991, p.3). To be able to fully understand and reach the purpose that has been outlined, the purpose has been divided into two parts;
(1) *How* companies are using blockchain technology to achieve competitiveness, and (2) the underlying process behind the choice of utilizing blockchain. Thus, the following research questions (RQs) have been developed:

1. What resource configuration must a company have access to in order to make use of blockchain as a resource?
2. What underlying processes are behind the choice of blockchain?

The first RQ seeks to discover how the technology serves as a resource, and for what purposes it is being used. We will also investigate the resource configuration in the case companies, and how other resources than blockchain contribute to the value of blockchain and thus the competitiveness of the firm. The value of blockchain as a resource can be dependent on different resource configurations for different companies, and blockchain can also contribute in different ways to the competitiveness. The second RQ seeks to discover the underlying process of choosing blockchain and common traits relevant to blockchain's role as a resource in the companies, among companies choosing to solve a problem utilizing blockchain technology. This will be investigated to see if or how one can obtain a competitive advantage with blockchain technology. Both of these RQs will be investigated through case interviews with companies using blockchain.

## 1.5 Contribution

With the collected data, we will be able to better understand the competitiveness of this fairly recent innovation, and what factors are affecting companies in choosing to utilize the technology. Knowing more about the background and processes in the companies that are pioneering the use of this emerging technology can give entrepreneurs in other companies better understanding of important factors to consider before choosing to build something on a blockchain. This will enable people to better evaluate the potential impact or requirements of using blockchain technology for a given purpose.

In figure 1.1 our contribution is visualized as the boxes outside the dotted area. The two boxes inside the dotted area is what we have argued being well-covered in the literature, except the link between them, which is the literature gap. Our contribution will be an investigation of the processes behind choosing blockchain technology for the problem it solves, or theoretically can solve. A further investigation will be done to identify the resource configuration of the firm, value of the technology, and how blockchain can contribute to the competitiveness of the firm.

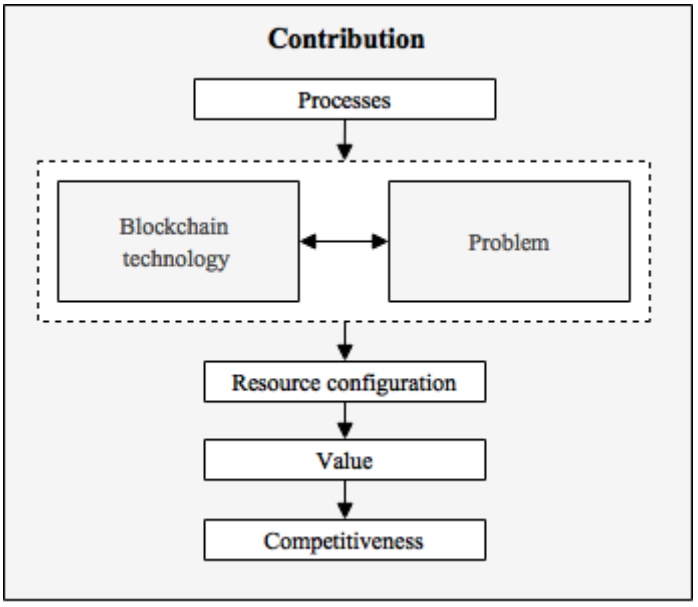


**Figure 1.1**: The contribution of the study

## 1.6 Structure of the master's thesis

During this introductory chapter it has been explained that blockchain is a recent innovation opening up new entrepreneurial opportunities that has not had the chance to be properly explored. This contributed to developing the purpose presented. In chapter 2, theories regarding resources, valuable resources, competitive advantages and the value of combining resources, together with the resource-based view, forms our theoretical framework. Chapter 3 describes the methodical choices that will be performed in order to answer the RQs and to follow the purpose of the master's thesis. To answer the research questions presented in chapter 1 the authors have chosen a qualitative approach with case studies as their research design. In addition to articles and documents; two field experts and four blockchain companies will be used to gather information. Chapter 4 contains a presentation of each case study, while chapter 5 presents an analysis and findings from the case studies. The analysis is ended by answering the RQs. Chapter 6 is a discussion of the key findings and the contribution of the thesis to previous literature. Chapter 7 is a conclusion, followed by chapter 8 where implications and recommendations to further studies are presented.

The terms “researchers”, “authors” and “we” are indistinguishable, and refers to the authors of this paper. The authors of this paper will be the ones conducting the outlined research.

# 2 Theoretical foundation

This chapter introduces the contextual framework the researchers applies to analyze their findings. It explains how resources, valuable resources and the combination of resources are defined and can contribute to competitive advantage for a firm. These aspects will then be discussed in a blockchain context and at the end of this chapter the researchers present the framework applied.

## 2.1 Theoretical framework

Schumpeter (1942) introduced the theory of creative destruction, which stresses that opportunities require new information and are innovative. Kirznerian opportunities, on the other hand, require new information and are less innovative (Kirzner, 1979). Hayek (1937) uses the definition of equilibrium proposing that opportunities are objective but their perception is subjective. If everyone had access to the same information they would be in equilibrium, but since this is not the case, perception of opportunities becomes subjective. This reflects a neo-classical economic tenet on the distribution of information and information processing by the entrepreneur (Vaghely and Julien 2010). Entrepreneurship is a process in which an individual perceives an opportunity to make money and then exploits it (Shane, 2003). The life of an entrepreneur consists of endless of opportunities. "Entrepreneurial opportunities exist primarily because different agents have different beliefs about the relative value of resources when they are converted from inputs into outputs" (Alvarez and Busenitz, 2001 p.755). The resource based view complements the traditional strategy that focuses on the industry structure (Porter, 1979), and instead has an internal focus on the firm. The resource-based view will thereby help the understanding of how firms can use their resources to achieve competitive advantages and make them sustainable for a longer period of time (Barney, 1991).

### 2.1.1 What is a resource?

A resource is anything that could be thought of as a strength or weakness of a given firm (Wernerfelt, 1984). We will here define firm resources to "include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm

that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991, p.3). Resources arise either from performing activities over time, acquiring them from outside, or a combination of the two, both reflecting prior managerial choices (Barney, 1991). When discussing what a resource is, it is important to note that there are different kinds of resources. One usually divide all of them into two categories, either they are tangible or they are intangible. It is argued by Schriber and Löwstedt (2015), Barney (1991) and Dierickx and Cool (1989) that intangible resources are more likely to be a source of sustainable competitive advantage since they are typically more difficult to imitate. They can be classified as 'assets' or 'competencies' (Hall, 1993), where assets include the intellectual property rights of: patents, trademarks, copyright and registered designs, as well as contracts, trade secrets and databases. Skills, or competencies, include the know-how of employees, suppliers, advisers and distributors, and the collective attributes which add up to organizational culture (ibid). Tangible resources on the other hand would typically include assets that have a physical form and are recognized as indispensable aspects of the context where organizational activities take place (Schriber and Löwstedt, 2015; Reed, 2005). We will be investigating both tangible and intangible resources, and the combination of these in the case companies.

### 2.1.2 What is a valuable resource?

Resources, both tangible and intangible, only have the potential to give rise to economic value if they are used to do something (Barney, 1991). What resources are supposed to do is to enable firms to create and implement strategies. In theory, a resource itself is "strategic" if it is rare among the firm's competitors and costly for them to copy or substitute (Massey, 2016; Barney and Mackey, 2005). In practice, resources become strategic to the firm when they produce or help to produce a "significant positive effect" on the firm's performance (Massey, 2016, p.3), which could for instance be, but not be limited to, economic costs or the perceived benefits associated with an enterprise's products (Peteraf and Barney, 2003). Using this definition, as long as the resource create a "significant positive effect", the resource is indeed strategic and valuable. These resources can also be referred to as critical resources in accordance with Wernerfelt (1989). According to Armstrong and Shimizu (2007) intangible resources are generally more strategic - that is, harder for competitors to copy - than tangible

resources. Companies should thereby strive to utilize these kinds of resources to its full potential, and search for ways to make their resources to be of this kind.

### 2.1.3 Combining resources

The availability of substitute resources will tend to depress returns to the holders of a given resource (Wernerfelt, 1984). It can be argued that firms need a strategy to protect themselves from such depreciations. The combination of resources can thus contribute to diversification from other holders of the resource or other possibly substituting resources. Case studies made by Hall (1993) showed that employee know-how is rated as one of the most important contributors to business success, which also is in tune with the writing of Prahalad and Hamel (1990). Combining this knowledge with the resources of the firm may thus strengthen the resources giving advantages relative to competitors' usage of the resources.

Penrose constituted in her own theory a powerful critique against certain aspects of the neoclassical theory of the firm. She claims that in the neoclassical theory of the firm there is "... no notion of an internal process of development leading to cumulative movements in any one direction (Penrose 1959, p.1). Growing is rather a matter of adjusting to the equilibrium size of the firm. "But if services then are produced endogenously (and continuously) through various intra-firm learning processes involving increased knowledge of resources, "new combinations of resources" (Penrose, 1959, p.85), and an expanding productive opportunity set, there is no equilibrium size" (Foss, 1998).

### 2.1.4 Conditions for competitive advantage

There is a general consensus in the literature that all types of innovations can contribute to a firm's competitive advantage (Han et al., 1998; Damanpour, 1991; Damanpour et al., 1989). The innovation literature primarily focus on technical innovations (Weerawardena and Mavondo, 2011). Weerawardena and Mavondo (2011, p.3) notes that "The competitors' inability to duplicate capabilities (Hayes et al., 1996; Bharadwaj et al., 1993; Reed and DeFillippi, 1990) or the 'capability differential' on which competitive strategy is founded (Hall, 1993; Coyne, 1986) is suggested as the key source of sustainability of competitive advantages."

The resource-based view of firms (RBV) is an influential theoretical framework commonly used for understanding how competitive advantages within firms are achieved and how they can be sustained over time (Eisenhardt and Martin, 2000; Teece et al., 1997; Peteraf, 1993; Barney, 1991; Nelson, 1991; Prahalad and Hamel, 1990; Wernerfelt, 1984; Penrose, 1959; Schumpeter, 1934). According to Peteraf (1993) four conditions must be met for a firm to have a competitive advantage.

(1) *Heterogeneity*. A basic assumption in resource-based work is that the resources and capabilities underlying production are heterogeneous across firms (Barney, 1991). This implies that a firm's capabilities are related to its ability to compete, break even or earn rents (Peteraf 1993). The key is that superior resources remain limited in supply, so that firms can have sustained competitive advantage only if their resources cannot be imitated by other firms, or expanded to the demand level (Wilk and Fensterseifer, 2003). Prahalad and Hamel (1990) points out that core competencies, which involve collective learning and are knowledge-based, are enhanced as they are applied, and that this aspect of heterogeneity may provide the direction for growth of the firm. Heterogeneity is necessary for sustainable advantage, but not sufficient (Peteraf, 1993).

(2) *Ex post limits to competition* are factors that keeps the rents from being competed away, meaning a sustained competitive advantage requires that the condition of heterogeneity is preserved (Peteraf, 1993). Rumelt (1987) describes this as isolating mechanisms, which protect individual firms from imitation. However, causal ambiguity (Lippman and Rumelt, 1982) is of particular interest and is what prevents imitators to know exactly what to imitate or what to do with the same resources as their competitors. This is elaborated by Dierickx and Cool (1989) who, among others, describe causal ambiguity as a factor preventing non tradeable assets to be imitated, stating that how imitable the asset is, depends upon the process of how it was accumulated.

(3) *Imperfect mobility* is a term used for resources that cannot be traded. A resource can be imperfectly mobile if it is tradeable but more valuable within the firm that currently employs it than it would be in another firm (Peteraf, 1993). Wernerfelt (1989) describes the key features of imperfect mobility as the fact that they will remain available to the company and that the rents will be shared by the company. These factors make imperfect mobility a necessary condition for sustainable competitive advantage (Peteraf, 1993).

(4) *Ex ante limits to competition* is the last condition that must be met for a firm to have competitive advantage, meaning that prior to a firm establishing a superior resource position, there must be limited competition for that position (Peteraf, 1993). If the competition is not limited, the assumption is that the anticipated returns of the superior position will be competed away. This requires a firm's foresight or good fortune to acquire the superior resource position in absence of competition. It is therefore important to recognize that the productivity of superior resources depends on the nature of how they are employed and the skill with which a strategy based on resource superiority is implemented (ibid). Dierickx and Cool (1989) and Barney (1989) have noted that even though only tradeable resources can be acquired in strategic markets, the argument of ex ante limits to competition can also be extended to imperfectly mobile resources.

To gain a competitive advantage can be viewed as the "Holy Grail" of strategic management research (Helfat and Peteraf, 2009, p.91), and the proposed model can be used as a basis to differentiate between resources which might support a competitive advantage from other less valuable resources (Barney, 1991). We will therefore apply it to our case companies. An important factor, described by Thompson and Strickland (1990) and Andrews (1971) is that the competencies and resources which are distinctive or superior relative to those of rivals, may become the basis for competitive advantage if they are matched appropriately to environmental opportunities (Peteraf, 1993). This is especially important regarding the nature of the blockchain technology environment investigated in this thesis, since the knowledge surrounding the environmental opportunities are uncertain.

## 2.2 Theoretical framework in a blockchain context

This research will apply the framework of resource-based theory in the context of blockchain. The blockchain technology itself can be analyzed as a resource, assuming resource heterogeneity across firms (Barney, 1991).

### 2.2.1 Blockchain as a resource

For the blockchain technology, it can be discussed whether this technology is a tangible or an intangible asset. The technology itself is purely based on code, which makes it a software solution. On one hand software is reliant on hardware, such as hard drives where it is stored, but usually when it comes to determining whether software is an intangible or tangible asset, it is said "when the software is not an integral part of the related hardware, computer software is treated as an intangible asset" (NZ IAS 38, 2004). Since the blockchain software has no central controlling part, but exists as copies of itself on multiple computers interconnected in a network, it is by this definition not an integral part of related hardware, and thus an intangible asset. This characteristic is incorporated in the framework presented in section 2.3.

### 2.2.2 Blockchain as a valuable resource

Intangible resources are generally more strategic than tangible (Armstrong and Shimizu, 2007). However, blockchain tend to be open-source, and is thus equally available for competitors, making it questionable whether it is a strategic resource in isolation. Authors such as Vigna and Casey (2015) points to blockchain being a hype and questions the technology's capability of being disruptive. An interesting topic is whether a hype surrounding the technology creates disproportion between projected value and actual value created from throughputs of blockchain companies. On the other hand Davidson et al. (2016) disagrees to Vigna and Casey's (2015) classification of blockchain as a hype, and underlines that blockchains can potentially disrupt any centralized system which coordinates information.

### 2.2.3 Combining resources and blockchain

This study of blockchain is focused on the technology combined with other resources. The combination of resources is an interesting topic to follow because the blockchain technology itself is open-source. Therefore, to see how a resource such as the blockchain technology can contribute to a competitive advantage, we examine the combination of this resource with other resources. "There is a close relation between the various kinds of resources with which a firm works and the development of the ideas, experience, and knowledge of its managers and entrepreneurs" (Penrose, 1959, p.85). Changing experience and knowledge will affect not

only the productive service available from resources, but also the demand as seen by the firm. For the enterprising firm, unused productive services are a challenge to innovate, an incentive to expand, and a source of competitive advantage (ibid). These services "facilitate the introduction of new combinations of resources - innovation - within the firm." (ibid).

### 2.2.4 How blockchain can contribute to competitive advantage

Blockchain technology can be viewed as an innovation and resource, and it can therefore be explored whether the technology creates an advantage for a firm utilizing it (Weerawardena and Mavondo, 2011). As earlier mentioned, an interesting aspect here is the property of the blockchain technology in that the core protocol tend to be open-source. Questions in the research will therefore follow a path where we examine how to combine blockchain, as an open-source resource, with other resources to obtain a competitive advantage.

## 2.3 Theoretical framework applied

As described above, the authors have chosen to look at blockchain technology as a resource, and formed the following theoretical framework using a resource-based view (RBV) in a blockchain context. The framework is distilled from relevant literature regarding resources and competitive advantages described previously, and consists of three layers:

- *Resources* (main layer) that involves "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991, p.3).
- *Valuable resources* (secondary layer) involves resources that is "strategic" and rare among the firm's competitors and costly for them to copy or substitute (Massey, 2016; Barney and Mackey, 2005). Resources become strategic to the firm when they produce or help to produce a "significant positive effect" on the firm's performance (Massey, 2016, p.3). As blockchain is an intangible asset, this layer revolves around topics concerning knowledge and competency that contributes to a "significant positive effect" (ibid).

- *Combining resources* (secondary layer) involves the combination of resources in the firm and how one perceives a competitive advantage by allocating resources in the blockchain industry.

This framework was applied to identify *how blockchain as a resource contributes to the competitiveness of the firm*, which is the area of overlapping layers in our model visualized in figure 2.1. The model is used by investigating blockchain as a resource and the other resources in the case companies, and how these resources are combined. The combination, or resource configuration, is then investigated to see how it contributes to the competitiveness of the firm. We investigate if a single resource is dependent on other resources or circumstances to be viewed as valuable or a source to competitive advantage. This information is then analysed regarding how the combination of resources might be a source to sustained competitive advantage.

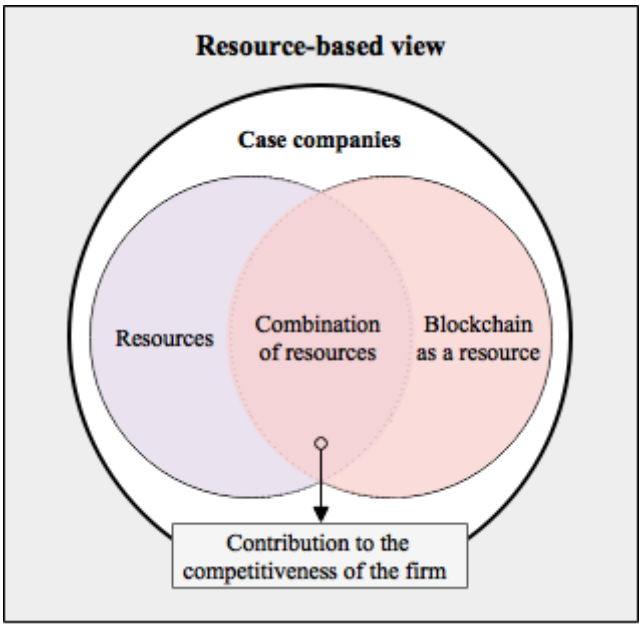


**Figure 2.1:** Analytical framework: Resource-based view in a blockchain context

# 3 Research method

This chapter will elaborate on the research method conducted in this study. It describes in detail the research design, data acquisition, data analysis, and presents a summary with reflections upon the method.

## 3.1 Research design

Due to the general and broad nature of the research questions in this study, we conducted a case study approach including multiple cases. This was an iterative process divided into several different steps (Yin, 2014). We planned the research by mapping out the use cases of blockchain through a literature review and listing use cases that were a good fit to our purpose in order to answer the research questions. This way the case studies were created making an overarching plan for how the study was organized (Thagaard, 2013). Since the purpose was to investigate *how* blockchain, together with other resources, contributes to the competitiveness of the firm - and there is little research on the subject - the qualitative method was chosen (Yin, 2014). The use of a qualitative case study allowed for wider insight into relevant factors and variables helping the researchers understand present dynamics within the field (Eisenhardt, 1989); an important factor due to the researchers' lack of in-depth knowledge on the subject prior to this study. This choice was also supported by the nature of the technology, being new and disruptive and therefore not covered broadly in the literature and with no similar technologies for comparison. Later, the data acquisition was conducted interviewing four companies, meeting given criteria (see section 3.1.2), within the blockchain domain.

### 3.1.1 Expert interviews

To complement what we see as deficient aspects in the literature, and to increase the possibility to find good cases for the thesis, we interviewed experts without economical stakes in blockchain technology. The purpose of the expert interview was to increase our understanding of the technology and its implications and applications, and to increase our chances of identifying good cases for our study. We conducted an expert interview with João Marcos Bargull, PhD candidate in computer science at the University of São Paulo. We met

Bargull at a blockchain workshop during the entrepreneur conference Slush in Helsinki, where he at the time was writing a book about blockchain.

Another expert interview was held with Mariusz Nowostawski, associate professor at NTNU Gjøvik. Nowostawski has worked on high-end networking applications on graphics processing units and multicore systems with Sun Microsystems and Oracle (Nowostawski, 2017). He is currently involved in forensics research with Europol regarding Bitcoin anonymity. Nowostawski is familiar with the blockchain environment, both nationally and internationally, and helped us identify interesting companies utilizing blockchain technology for our research.

### 3.1.2 Case study

To explain a contemporary and delimited phenomenon like the blockchain technology, and investigate its opportunities, we performed a case study approach (Gerring, 2004) where we focused on understanding the dynamics present within single studies (Eisenhardt, 1989). We selected four case companies to perform our case study, and then considered the gathered data before expanding the data collection (Dalland, 2012). To take full advantage of our approach we made the following inclusion criterion to select our cases:

- The case companies must utilize blockchain as their core technology.
- Each case must be within different areas of application defined by Blockchain Technologies (2016) (see table 1.2 in section 1.1.2).
- All three stages in Swan's (2015) development model for blockchain (see table 1.3 in section 1.1.2) must be represented by the case companies.
- The company must have had a run time for at least twelve months. We want to track processes from a blockchain opportunity was taken, hence we needed to exclude projects in its infancy.

Due to blockchain's generic characteristics we started out by following Blockchain Technologies' (2016) official division of areas of application and chose the four main categories to be able to cover every aspect of the use cases. In addition, we followed Swan's (2015) division of the development stages to include the different phases of the technology. We used multiple sources, such as Angel List, CoinDesk and Blockchain Technologies, to

make a list of 30 possible companies. In order to get a second opinion and reducing our list we reached out to Bargull and Nowostawski. This reduced our list down to 7 suitable candidates of which four were interested in contributing to our master's thesis. We ended up with the following case companies; Blockstack Inc, Bernstein Technologies GmbH, Evry Norge As and the IOTA Foundation.

Blockstack is creating a new decentralized internet and by that trying to solve problems related to vulnerability with the traditional internet. They have had a run time for over 4 years and fit into the category of *Identity* by creating a secure internet identity that gives the user control over their own data and how it is distributed over the internet. Bernstein have created a platform where you can get a certificate to prove that you own an intellectual property (IP) in the form of a tamper-proof document linked to the Bitcoin blockchain. They have had a run time for almost 2 years and fits into the category of *Property* by delivering an IP management solution that enables users to prove the origins of their IP. Evry has created a platform where financial institutions can collaborate on syndicated loans. The Evry project have had a run time since early 2016 and fits into the category of *Law* by making the legal processes in regards to syndicated loans digital and less time consuming via smart contracts. IOTA has created a platform where a machine economy between people and internet of things can exist. IOTA have had a run time of 4 years and fits into the category of *finance* by enabling trade between smart property and people. IOTA would fit into Swan's (2015) development stage of Blockchain 2.0 when their platform is released in its full service, but at the time of writing they only allow for trades between individuals making it a Blockchain 1.0. Even though these cases are operating in different problem spaces, they are all comparable empirical cases (Eisenhardt and Graebner, 2007) in that they are all trying to create value with the same underlying technology. Detailed information in regards to the cases and their categorization is presented in table 3.1 and 3.2 below.

**Table 3.1:** Case companies categorized based on Blockchain Technologies' (2016) division of applications and Swan's (2015) division of development stages

| Case company | Area of application | Stage | Explanation |
|---|---|---|---|
| IOTA | Finance | Blockchain 1.0 | Creating a machine-human economy, also making it feasible for Internet of Things to do automatic trades with each other on a blockchain. |
| Bernstein | Property | Blockchain 3.0 | Enabling storing of intellectual property on the Bitcoin blockchain providing users with a certificate. |
| Evry | Law | Blockchain 2.0 | Allows financial institutions to collaborate on syndicated loans on a platform via smart and self-executing contracts making legal processes digital and less time consuming. |
| Blockstack | Identity | Blockchain 3.0 | Building a new decentralized internet providing you an identity on the internet in which you own, in addition to keeping all your personal information secure without leaving it on the web-pages you visit and sites you register. |

**Table 3.2:** Detailed information regarding the case study companies

| Cases | Blockstack Inc | Bernstein Technologies GmbH | Evry Norge As | IOTA Foundation |
|---|---|---|---|---|
| **Run time** | Founded June 2013 by Ryan Shea and Muneeb Ali (Ali 2017b; Shea, 2017a) | Founded fall 2016 by Florian Weigand, Paul Reboh and Marco Barulli (Bernstein, 2017) | Project started spring 2016 | Founded in 2015 by David Sønstebø (Sønstebø, 2017) |
| **Number of employees** | 7 | 3 | 3-8, where 3 are working on a daily basis | 18 |
| **Team** | 3 PhDs in distributed systems from Princeton<br>1 Computer science major also studying rocket science at Princeton<br>1 Experienced full stack developer<br>1 Experienced designer<br>1 Growth partner | 1 Product and business developer with prior experience with bitcoin/blockchain<br>1 Full-stack engineer acting as Technical Lead, Solution Architect, Agile Product Owner, and Technical Product Manager<br>1 Senior software engineer | 1 Project Manager<br>1 business analyst and technical design/architecture<br>1 user experience designer<br>1 front-end developer<br>1 middleware developer<br>1 senior back-end developer<br>1 infrastructure developer | 18 Full-time (Mathematicians, programmers, cryptologists)<br>12 Students from UC Berkeley working on different use cases as part of their master's degree |
| **Funding** | 6.79 million dollars from 10 investors. | Initial funding received from Telefónica, and planning a second round of half a million Euro | N/A | IOTA as a foundation holds an undisclosed amount of tokens that are worth tens of millions of dollars, meaning IOTA is funded through selling their own tokens |
| **Operational revenue** | None | None, but have contracts that might lead to it soon | None | None |

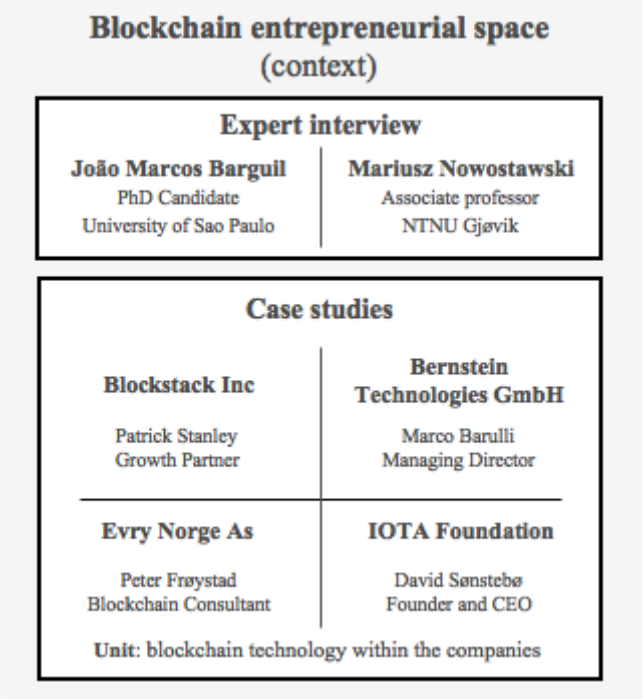


**Figure 3.1:** The case study design

## 3.2 Data Acquisition

The main method the researchers used for gathering information for the thesis was empirical data from decision-makers within the case companies, due to their in-depth knowledge about the processes involved with the technology choice. Relying only on interviews though, may decrease the validity of the research. For this reason, the research also includes secondary sources of data (Yin, 2014). The researchers used a triangulation principle in order to increase the validity of the research. To cross-validate the interviews we used a combination of the case company's website together with sites such as, LinkedIn, Angel List and publicly available documents, presented in table 3.3. We also leveraged on the archives of CoinDesk to provide contemporary information regarding the cases. According to CoinDesk, they are "the world leader in news and information on digital currencies such as bitcoin, and its underlying technology – the blockchain" (CoinDesk, 2017) and can provide context with respect to associated market situations, and the performance of each organisation in its market (Schriber and Löwstedt, 2015). The data collected was organized and maintained keeping a "chain of evidence" (Yin, 2003), and is presented in chapter 4. A detailed breakdown of the data samples are listed in table 3.3 below.

**Table 3.3:** Detailed breakdown of data sample

| Case companies | Primary | Secondary | | | | | |
|---|---|---|---|---|---|---|---|
| | Interview | Home page | LinkedIn | AngelList | Papers | CoinDesk | No. Sources |
| Blockstack | 1x Growth partner | 1 | 3x profiles | 1 | 1x Whitepaper 1x PhD paper | 2 | 10 |
| Bernstein | 1x Co-Founder | 1 | 1x profile | 1 | - | - | 4 |
| Evry | 1x Business analyst | 1 | 1x profile | - | 1x Whitepaper | - | 4 |
| IOTA | 1x Founder | 1 | 1x profile | 1 | 1x Whitepaper | 1 | 6 |

### 3.2.1 Execution of expert interviews

We predefined three roles during the interviews; *interviewer* and *two observers*. The *interviewer* would focus on keeping the conversation going and following the path set by the interview guide. The *observers* would pay close attention to the answers and provide the interviewer with follow-up questions that were relevant for our scope and theoretical framework. The expert interviews had an approximate duration of 45 minutes, and by creating an interview guide (see Appendix) the scope was set for the interview and made sure that we asked open and relevant questions. Due to blockchain having different value propositions in different use cases, questions regarding promising use cases and problem spaces - in the expert's opinion - were asked about. We also focused on limitations of the technology.

### 3.2.2 Execution of case interviews

Interviews are one of the most crucial tools to obtain case study evidence (Yin, 2014). The researchers' lack of in-depth technical knowledge of blockchain prior to the research implies that the interviews should be performed in such a manner that the researchers get a best possible understanding of the interviewee's frame of reference. Therefore, due to their increased flexibility and focus in understanding the interviewee's perspectives of events, patterns and behaviours (Bryman, 2008), semi-structured interviews were used to collect the

data. The semi-structured interview also allowed the interviewee to pursue topics of particular interest (ibid), and enable the authors to capture activities, reflections, behaviours and processes that may not have been covered by the theoretical framework (Kvale, 1996). To capture different perspectives, we wanted to interview individuals with different stakes in the company. In table 3.4 below, we present the business developer, project lead, and the two co-founders.

The researchers tried at best to be aware of the importance of not asking leading questions and followed an interview guide (see Appendix) with articulated questions in advance. The case interviews sought to ask questions which would help reveal the nature of the motivation behind the choice of utilising blockchain technology, and to have the interviewees elaborate on their thoughts regarding the choice and result of choosing blockchain, how they use it and the role(s) of blockchain in their strategy and operations. The focus of the interview guide was to investigate blockchain's value and what resources they actively use. Follow-up questions would revolve around reasoning for choice and what is needed to imitate or copy what they are doing. We also sought to ask open questions to reveal their thoughts on why not choosing other technologies for their service. The interviews had a duration between 45 - 75 minutes. The variation of the duration was mainly caused by the nature of open questions, enabling the interviewee to speak freely (Kvale, 1996). The authors recorded the interviews, enabling the interviewer to pay full attention to answers during the interview and provide time to think of follow up questions. We had defined roles as *interviewer* and *observers*. After each interview, we considered whether to edit our interview guide or not, making the process iterative. The interviews were transcribed afterwards using the recordings. Recording and transcribing interviews afterwards like this enabled the interviewer to focus on the environment and enthusiasm of the interviewee, and other impressions the researcher may get in the field, resulting in valuable data to analyze which also strengthens the research (Kvale, 1996; Eisenhardt, 1989). After transcribing the interviews we sent follow-up questions via email to get more information about their coworkers and competitors to better understand the context they operate in.

**Table 3.4:** Interviewees in the case study

| Cases | Blockstack Inc | Bernstein Technologies GmbH | Evry Norge As | IOTA Foundation |
|---|---|---|---|---|
| **Interviewee and role** | **Patrick Stanley**, growth partner (Stanley, 2017), increase the core interaction of Blockstack. | **Marco Barulli**, Co-founder and managing director. | **Peter Frøystad**, blockchain consultant, performs business analysis and technical architecture | **David Sønstebø**, Co-founder and leader (Sønstebø, 2017) |
| **Interviewee's background** | Studied information theory at the Johns Hopkins University. Heard about Bitcoin in 2013, started working on the financial aspects in 2014. Involved in blockchain community over Twitter, and has hosted a few blockchain hackathons for developers about micro services for micropayments. | Master's degree in computer science from the university of Bologna. Experience with entrepreneurship, cryptography and computer science. Bernstein is Marco's third startup, but the first based directly on blockchain. | Computer science major at Norwegian University of Science and Technology (Frøystad, 2017). Peter read for the first time about Bitcoin in 2013. In 2015 he wrote a whitepaper about what Blockchain was for Evry. | No higher education. Got interested in blockchain on an early point. Started to work with blockchain in a startup called NXT back in 2012. *"NXT was the first blockchain 2.0"* according to Sønstebø. He met Sergey Ivancheglo at NXT, whom he currently works with in IOTA. |

## 3.3 Analysis of data

Analyzing qualitative data is challenging due to the fact that the data material often is vast and mainly consist of unstructured textual data. There are also few established rules as to how such research should be conducted (Bryman and Bell, 2015). We used the proposed theoretical framework from section 2.3 to analyze the gathered data, by grouping the information from our interviews and preparing them for analysis. We divided the information into several different topics referred to as nodes in the qualitative analysis software NVivo 11 Pro. The nodes we chose are based on our theoretical foundation. We wrote a list of all the relevant keywords from chapter 2, then grouping them into topics. Initially we ended up with six nodes to use for the coding (see figure 3.2 below). After working with the coding of the interviews, we saw that some of the nodes ended up with a disproportionate amount of content, while others were barely used. Following Kvale's (1996) analysis methods, the data was recategorized. The node "Value propositions" had 37 references, and we therefore chose to split it up into two separate nodes called "Customer value propositions" and "Company value propositions" for the two different aspects of information, enabling us to reach a

desirable level of abstraction (Lee 1999; Strauss and Corbin 1998). After the coding, the grouped information was analyzed by using the definitions in our framework to discuss the relevance in regards of each case individually and collectively. This helped identifying important information to answer the topic of the study (Yin, 1981). Utilizing the proposed framework for the study to understand our data and compare the existing literature with the emerging theory that takes form during research enhances the internal validity, generalizability and theoretical level of the research (Eisenhardt, 1989).

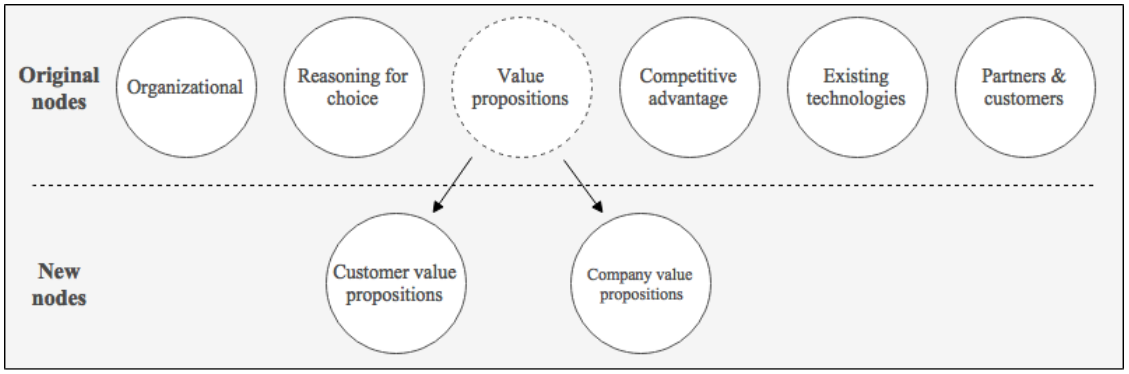


**Figure 3.2:** Nodes used for coding

## 3.4 Reflections on the method

The type of information collected through the interviews, potentially colored by the views of the respective organisations, make it especially important to interpret and discuss data from multiple sources before any conclusions are made (Yin, 2003). We reviewed data from documents, articles, case- and expert interviews. Another aspect is that the informant could give the answers he thinks the researchers wants to hear. When using a qualitative case method it might also be difficult to assess which are the most important relationships in the findings and what is particular for the exact case (Eisenhardt, 1989). However, the method also has its strengths, such as a high likelihood of generating a novel theory, that the results are likely to be testable, and that the results probably are empirically valid (ibid).

### 3.4.1 Quality of the study and ethical considerations

Lincoln and Guba (1985) state that trustworthiness is important to evaluate a research study's worth. They further state that trustworthiness involves establishing *credibility, transferability, dependability and confirmability*.

Triangulation, which is gathering data from multiple sources, was used in this research. The primary data sources were the interviews, but we also gathered information from secondary sources through reading white papers (Ali et al., 2017; Popov, 2016; Frøystad and Holm, 2015), the companies' web pages (Bernstein, 2017; Blockstack, 2017; Evry, 2017; IOTA, 2017), articles (Castillo, 2017; Keirns, 2017; Oliver, 2017), a PhD (Ali, 2017a) and profiles on Angel List (Angel.co, 2017a; Angel.co, 2017b; Angel.co, 2017c) and LinkedIn (Ali, 2017b; Barulli 2017; Frøystad, 2017; Shea, 2017; Stanley, 2017; Sønstebø, 2017) as shown in table 3.3. This increases the *credibility* defined by Anney (2014) as the confidence that can be placed in the truth of the research findings (Macnee and McCabe, 2008; Holloway and Wheeler, 2002).

Through explaining our research process, and how blockchain is used in each of the case companies, in detail, we handled *transferability*, that refers to showing that the findings have applicability in other contexts (Lincoln and Guba, 1985). Our interviewees were willing to share detailed descriptions, which forms the foundation to later evaluate if the conclusions made are transferable to other settings. Li (2004) states that to enable judgements about how well the research context fits other contexts, you need a rich and extensive set of details around methodology and context.

We used a case study protocol to meet the requirement for trustworthiness, referred to as *dependability*, which is about showing that the research can be repeated with the same results (Lincoln and Guba, 1985).

By external audits, which involve having a researcher not involved in the research process examine both the process and product of the research we increased our research *confirmability,* that refers to the degree to which the results of the inquiry could be confirmed

by other researchers (Baxter and Eyles, 1997). Achieving confirmability is about minimizing researcher bias affecting the results.

The authors asked for permission to conduct the audio recordings of the interviews, and each participant had the opportunity to receive the transcript of their interview, prior to conducting the analysis, for them to correct and comment on the statements made. The participants were informed consent, which means that they must give permission to let the researchers use the data collected from them. At the same time, the researchers provided confidentiality if the participants wished so, which means that the data collected can be required to be kept and stored in a safe way by the researchers (Thagaard, 2013).

### 3.4.2 The researchers

The researchers had practically no prior knowledge of the topic of the study before start. This underlines the importance of having a flexible research method where the researchers are continuously open to new ideas and impulses without being biased by single-minded impulses from case companies, experts or articles. This can create a ”biased viewpoint effect”, which can detriment for other ways to look at the phenomenon (Ringdal, 2013). However, the researcher’s role as a question finder could be strengthened by the lack of pre-understanding on the technical aspects of the research topic. The researcher is regarded as an active participant in a knowledge development that can never be complete, but that is more about new questions than about universal truths (Flick, 2015). The researchers do have practice and experience from startups and working with new technologies, and all have technical backgrounds, which may have helped contribute to a deeper understanding of the topic of the study.

### 3.4.3 Limitations of the study

Four companies were selected, which is within the minimum of recommended cases by Eisenhardt (1989), to conduct our case study. Investigating such a generic technology, with numerous applications, and having four cases we chose companies that were widely spread in the blockchain space. This can make it hard to obtain nuances in between cases. However, by using the most agreed upon division of the blockchain applications by Blockchain

Technologies (2016) and development stages by Swan (2015), together with assistance from Bargull and Nowostawski, we are confident in that we cover the main aspects within blockchain application categories.

As mentioned, blockchain is a recent technology that still has not had the time to prove its valuable use cases. This is reflected in the cases by neither of them having any operational revenue at the time of writing, nor does any other blockchain companies to our knowledge, hence having no real value creation yet. The absence of operational revenue may conceal a company's potential profitability or success. This forced us to focus on value adding throughputs that does not involve a paying customer. To compensate for the absence of operational revenue, we looked at different credibility criterion. These were: reputation of investors, amount of funding, acknowledged partners, backgrounds of founders, size of community, belonging to reputable corporation and research publications by the companies.

# 4 Case studies

In this chapter we will present the data collected through interviews and secondary sources in regard to our four case companies.

## 4.1 Case 1: New decentralized internet

Blockstack Inc aim to fulfill Vint Cerf's and Sir Tim Berners-Lee's (father of the Internet and inventor of the World Wide Web) original vision of a completely decentralized internet.

**Background**

Blockstack Inc was founded by Ryan Shea and Muneeb Ali in 2013 (Shea, 2017a; Ali, 2017c) and is building the structure of a new decentralized internet. They are also creating a supplementary browser that will allow users to access the internet and developers to create content and applications on it.

Our interviewee, Patrick Stanley, growth partner and responsible for the core interaction of Blockstack, sees the internet as a fragile solution based on trust, where you have central units that store data and redirect traffic (data transfers). These central units are relying on users trusting in them to be secure and safe, but in reality they are prone to attack from malicious users, more commonly referred to as hackers. Stanley identifies this as one of the reasons why Blockstack wants to decentralize the internet; to remove vulnerable central units storing and handling data. In addition, it is hard to keep track of all the services on the internet that owns information about you, because these services are the central unit in which you connect and store your data. Blockstack wants to turn this around, and make users the 'contact points' that owns information about themselves where services need to ask for permission to get access to your personal information (Ali et al, 2017). Blockstack is enabling developers to build server-less, decentralized applications where users own their own data (Oliver, 2017).

**Business model**

By building a browser where users can access content and applications on the decentralized internet, Blockstack is able to charge a nominal fee for registering domain names - just like the traditional internet. By creating their own cryptocurrency and only allowing that currency to pay the nominal fees, they expect it to become a valuable currency. Through the platform where developers can create content and applications that users can pay to access, they see the potential in creating identity and storage solutions on top of their own platform.

**Partners, customers and competitors**

Through their platform, Blockstack has two groups to cater to; the developers, and the users. They are also teaming up with partners, where Stanley informs that Microsoft is considering moving over their identity system to Blockstack.

Blockstack's biggest competitor is Ethereum, even though they are not making the same type of platform. According to Stanley, Ethereum does not create something that is built to scale and to last and he is convinced that it is not clear that Ethereum is going to be the winner. Blockstack's second competitor is internet itself, as everyone can just keep on doing what they have always done. This underscores one of their main challenges - adoption.

**Challenges**

According to Stanley, their main constraints as a company is to increase the core interaction of Blockstack. He addresses the need for developers to build applications and users to interact with these, meaning that Blockstack has the two sided market problem; on one hand you have to engage developers to build applications and content, then on the other hand you need to engage consumers and users to interact with them. That is why Blockstack is very developer focused now, with a large developer base that is actively building applications.

**Blockchain in Blockstack Inc**

As mentioned, Blockstack sees internet as a fragile system due to its structure with central connecting points. Data, identity, credit card information, photos and virtually everything you have written is all over the internet. Large databases are prone to hacking, and the hackers have the possibility to ask for ransom in the form of untraceable digital currencies. This is the

problem Blockstack had at hand to start with, according to Stanley. Blockstack was then built from first principles. The team's starting question was: "if we're gonna build the decentralized internet and build decentralized applications that doesn't involve any vulnerable 3rd parties on top of that, where do we start?". The Blockstack team then had a thorough process and deduced the problem down to three challenges; trust, discovery and performance.

1. **Trust**

The fundamental questions were: "How can you trust a network? On the internet, how can you as an individual know that everything you see is accurate? How can we establish a trusted network without relying on any remote servers?" That is how Blockstack got the end-to-end principle, like Tim Berners-Lee and others were trying to do when they first created the internet. Blockstack found blockchain as a solution to the challenge through seeing blockchain as the global database that shows ordering as an anchor for domain name system (DNS).

2. **Discovery**

"How can users discover relevant data without relying on central services?" By building a DNS on top of a secure blockchain you can create a backbone where users can verify identities because your public key will attest who you are.

3. **Performance**

Blockstack wants each user to be able to store their data wherever they want. They have therefore created a system that allows people to access their own and other people's data at roughly the same speed as the traditional internet.

Because of these three challenges, the process of implementing blockchain technology in Blockstack started out with the backbone of the internet; DNS, public key infrastructure and certificate authorities. Today those are all third parties that tell you where your servers are. Blockstack replace the internet DNS with their own DNS called 'blockstack domain name system'. They decentralize DNS completely, by storing it in the blockchain, choosing the most secure and tested blockchain currently invented; Bitcoin. Then they add a storage layer, which enables users to store their data and identity on either a local server or in cloud services like Google, Amazon S3, Dropbox or similar, which are turned into dumb, fully encrypted drives. By distributing your information across these servers, chances of downtime

are virtually zero. The 'Blockstack Browser' allows developers to create decentralized applications that hook onto individual users' APIs. In other words, Blockstack uses blockchain technology to remove the insecure trusted third parties that stands between user, applications and their data, and giving consumers control over their personal information on the internet.

**Value propositions and competitive advantage**

Stanley points to two main sources for Blockstack's value propositions; the Blockstack Domain Name System and the API they have developed. The new DNS removes the centralized points of trust that, according to Stanley, weakens the traditional internet.

Blockstack allows consumers having their own API, again allowing developers to create decentralized applications that hook onto these. This brings new conditions for online consumers, and Blockstack identifies new value propositions for their consumers. Stanley points out that consumers will now own their own personal data, and instead of having central repositories with a database of users and their data - you can now operate with just using different user's APIs.

According to Stanley, Blockstack is the first system that is built full stack for developing decentralized apps on a decentralized internet, and the first to build a decentralized internet that actually works. He highlights the team, that has worked together for three years, and its unique insight and competency as a key resource in building a decentralized internet.

## 4.2 Case 2: Intellectual property management

Bernstein allows companies to create a trail of records of their innovation process on the bitcoin blockchain. Inventions, designs and proofs of use can be registered and a blockchain certificate will prove ownership, existence and integrity of any IP asset. All information uploaded will remain private due to a unique cryptographic layer (Bernstein.io, 2017).

**Background**

Bernstein is built on knowledge from a combination of the managing director and co-founder Marco Barulli's two previous companies. His first was an internet company doing online media monitoring from 1998 to 2005, before social media and RSS feed. The second startup was focusing on browser cryptography enabling a web-app with an architecture that knows nothing about the user data, also called a zero-knowledge web app. Bernstein started out with a presentation of the idea of using the Bitcoin blockchain as a notarization platform to Telefónica, the Spanish telecom operator. Barulli were thinking of combining cryptography in the browser and notarization on the blockchain, meaning you would be able to provide certification services to companies without getting in contact with their data, which is now what Bernstein does. Bernstein is leveraging the cryptographic layer developed in the previous company, and they combine it with the blockchain to provide certificates that can prove existence of ownership and integrity of data. One problem Bernstein solves is that if you want to make prior art, you have to have an undisputable time stamp. You also need to be able to prove that that information actually was was available at the time of the time stamp. If you put something on your website it is hard to prove when you did it, and it is even harder to prove that you were the one that created it. Bernstein solves this through offering software as a service in the form of a simple web-application, where nothing is installed locally. They offer a few flat-rate plans for creating certificates of digital content. You subscribe to their service deciding how many certificates you may need, given your volumes of work. Blockchain is not a part of their revenue model, and they are currently not accepting Bitcoins as payment. However, blockchain is an essential part of the product and service they offer to their clients, without being an integral part of their revenue model.

**Partners and customers**

Bernstein started a pilot with six companies in march 2017, and will be starting two strategic partnerships soon:

(1) The XC is the former Unit Parker Enterprise and will offer Bernstein's solutions to one of their clients. There will be a small difference from the core product, which is that the data is going to be stored on a local storage. The web application will be in the cloud, providing access to the blockchain and encryption using the web application. Barulli states that

Bernstein have partnered with them to combine XC's solution for local encrypted storage with Bernstein's web application. He further explains that for many companies, especially IP-intensive high-tech companies, it could be a problem to move data, even encrypted, outside of their premises.

(2) NOKIA and Bernstein have an open innovation project on defensive publishing. It is done through using both the Bitcoin blockchain and an inter planetary file system (IPFS). IPFS is a distributed file system (like BitTorrent) combined with GIT. This means you are able to publish something and prove that you have published it. Bernstein use the blockchain to prove that the customer have decided to publish, and use IPFS to prove the location where the content is available. If you publish something on the web today, you get an URL to that content. The problem with URL is that it is disconnected with the content of the page, so you can change the content of the page, but the URL will remain the same. IPFS on the other hand is a content addressable space. With IPFS the content will be stored with a URL that is linked with the content. So if you change one bit in the content, you are moving the content to another address. According to Barulli, this means that if you are using IPFS with a certificate to say that some information has been published and is available at a certain location and you register this on the blockchain, that will be strongest proof of publication that you can come up with. This is what Bernstein will to do with NOKIA.

**Blockchain in Bernstein**

Bernstein uses the Bitcoin blockchain to insert a "cryptographic fingerprint" into a collection of documents into Bitcoin transactions. This enables them to prove that the person who created a specific transaction is also the owner of a certain time stamped digital asset. As Barulli states: "It is not just a receipt, it is a certificate, because a receipt does not say anything about the owner of that transaction. The protocol is therefore designed in a totally agnostic way of the underlying Bitcoin blockchain." When choosing which public blockchain to use as the underlying technology Bernstein selected Bitcoin because it is the most robust and the one with the most mature tools to build something on top of. Barulli is grateful that they did not decide to go with Ethereum because the protocol is still changing too much in the fundamentals, which makes it difficult to build stable applications on top. In one year that

might be different, and Bernstein's goal is to provide an option to use it, enabling users to decide which public blockchains it wants to register an asset on.

**Process of choosing blockchain**

In one of Barulli's previous companies anonymity was an important part of their architecture, because they did not want to link real identities with data, due to its serious vector for attacks on data security. At the same time they wanted to get paid for the service provided, so they started looking into Bitcoin with the goal of solving that in late 2011. Bitcoin enabled them to get paid without creating a link between the person that pays them and the data. Barulli started looking into blockchain, because it was a way to get paid without knowing the identity of the people that was paying. Later Barulli moved into the intellectual property space, where he saw that blockchain technology could serve as more than just a means of anonymized payments. He states that for many companies it is important to be able to prove the existence, the integrity and the ownership of any kind of digital asset. This is often troubling for companies that generate a lot of digital asset data. So Barulli and his partners thought blockchain could be a viable solution for a wide range of problems within this domain.

When asked about solving the same problem without using blockchain technology, Barulli says that Bernstein could not have provided the same kind of value to their customers without it. He identifies two characteristics with blockchain as being the reason:

1. **Permissionless:** The blockchain allows anyone to participate. Anyone skilled enough can create the certificates for themselves and send out a properly crafted transaction. You do not have to ask anyone's permission to do that.
2. **A transaction is uncensorable:** The network will process your transaction, no questions asked.

**Value Propositions**

Barulli identifies four main value propositions Bernstein delivers to its customers:

- Selling the convenience of accessing strong cryptography and accessing the blockchain. Also offering encrypted version storage along with the opportunity of generating certificates. The customers have the certificates and the data themselves,

so the protocol is independent of Bernstein. You can verify the certificates even if Bernstein go out of business, as long as you have the certificate and a copy of the data

- Bernstein ignores what customers are using the blockchain solution to store. Bernstein will give you a certificate for any kind of asset, even if it is a meaningless picture or document. For privacy reasons there is no validation of the content.
- They enable customers to get a solid trail of records for their innovation processes.

**Competitive advantage**

Barulli identifies confidentiality as an important competitive advantage for Bernstein. The team at Bernstein has 10 years of experience with creating third party data confidentiality. Barulli identifies the hard part about what Bernstein does as the crypto layer, which is executed in the client browser. This makes Bernstein a zero-knowledge web app, a blind notary able to certify digital assets on the blockchain without having access to the certified data. Bernstein provides data certificates without ever seeing the data. According to Bernstein's webpage this is cheaper, easier and more convenient than going to a notary (Bernstein.io, 2017).

Barulli identifies execution time as the main constraint for growth, because there are already other competitors moving in the space and he sees the market is getting ready to accept this solution. Therefore, Barulli sees fundraising as critical because it is related to the speed of execution.

## 4.3 Case 3: Syndicated loans

As Norway's largest IT company, Evry has comprehensive deliveries to Norwegian and Nordic business, financial and public sector government, municipalities and healthcare sectors (Evry, 2017). We interviewed  Peter Frøystad, blockchain consultant at Evry Norge As, about their ongoing blockchain project.

**Background**

Evry wanted to acquire competency on blockchain technology, so they initiated a project to develop a solution within their scope. Frøystad says the initial project started in fall of 2015

with a research project where "the main goal was to research the technology and its nature. It was never meant to create a real product that they needed to make profit out of". This research resulted in the hiring of Frøystad to initiate a commercial project. Three people were set on to find a project suitable for Evry's operational space. They specified a project and how much resources they would need to execute. In the fall of 2016 the team had identified syndicate loans as a fit. They are now creating a platform where banks can communicate and collaborate, to make the process of syndicate loans digital and more efficient.

**Partners, customers and competitors**

Frøystad acknowledges the advantages of being a large enterprise. They leverage that fact by getting meetings with the administration of larger banks that is currently their customers of other products. As of today, Evry has not signed any contracts with customers or partners regarding their blockchain solutions, but they have some that are interested.

Evry are looking for a customer or partner that wants to build the system together with them. According to Frøystad "the network effect is so important in blockchain products, that you cannot sell it the traditional way, where you first create a product and then sell it. You have to have people committed, being in the project all the way from the start, or else it is impossible". R3[1] based their company on this fact, if they could not get the banks onboard from the start, when building a new financial infrastructure, you will never get them interested later either. Evry is using part of that thought to get the banks involved. Frøystad reflects that this does make it harder, as it means you have to find someone willing to set aside the resources for development to make it, and there are not many companies willing to do that in Norway today.

There are not many actors to be considered as competitors in the Norwegian market today. According to Frøystad "no one in the world has blockchain deliverables today, at least no one that has any operational revenue". There are only some supply chain solutions that are being built in the world, for example Wal-Mart, Mesk and Alibaba are experimenting with and

[1]**R3** is a distributed database technology company. It leads a consortium of more than 70 of the world's biggest financial institutions in research and development of blockchain database usage in the financial system (R3members.com, 2017).

building solutions on blockchain. According to Frøystad the consulting companies in Norway are mainly the ones looking at blockchain and they do it to get educated on the topic so that they are ready when there is a pull from the market. “Consulting companies need competence on it, but few of them have any practical experience. There is no practical experience because there are no customers in the field so far”, Frøystad states. The ones that do work for customers are mainly smaller consultancy firms doing concept development and workshops for other smaller companies.

Within the syndicated loan space the US company Symbiont (Symbiont, 2017) working with it, but Evry have not looked into them or tried to find other competitors, because their project was never meant to be a product in the first place. Nets is considered a competitor on several payment solutions, having their own ongoing blockchain project, but they are not a competitor in regards to blockchain solutions. Frøystad meets the employee that are responsible for blockchain solutions in Nets very often, and they look at projects they could possibly do together, even though they technically are competitors.

**Blockchain at Evry**

During the creation of his white-paper (Frøystad and Holm, 2015), Frøystad saw the possibilities of blockchain, and what others had done. Evry then wanted to do their own project, and the process on finding that project started. Many different use cases were proposed, and some of them were done in-depth research on, like for example trade finance and international payments. Evry wanted to use the technology on a real business problem, “it was not ideal to start out with a technology and then finding a problem, but that was what we did”, Frøystad reflects. After a brainstorming process between Frøystad and his superior, Jarle Holm, where they looked at business processes and matching it with products and competencies they had in Evry - they started looking at syndicated loans. With Evry already having a product for syndicated loans, Frøystad felt it was a good fit. Frøystad could see some business possibilities, but they had no use case. After talking to a lot of Evry’s employees working with syndicated loans, and presenting on a yearly customer forum on Evry’s syndicated loan product about the possibilities of Blockchain, they had some discussions with customers about the problems of syndicated loans today. They figured out what they could do, and started a development project the summer 2016. First they started out

with automatic payments by using Ripple, as payments seemed like the obvious starting point, but the team soon realized that payments work well enough today and is not a big problem. Norway has an advanced payment system for very fast payments that is both efficient and inexpensive, compared to other countries like the US and South-East Asia, where they "use very slow carrying systems that are costly and do not work as well" Peter explains. After going in depth on syndicated loans they found that such loans were a custom to manual labor and a system very much based on trust. According to Frøystad they concluded that syndicated loans was the perfect use case for Evry based on these characteristics.

As a part of the process of implementing blockchain Evry looked at what Bitcoin does. It digitizes an asset, and track it. The team saw possibilities for doing this on the syndicated loan, giving stocks out to the different banks for their shares of the loan. This could be digitized so that you at any point could see how much each of the partners have, and selling and buying of stocks would be made easy. Today, selling out the loans to other banks is hard. It is performed manually, there is little digitalization and it is a time consuming process of finding partnering banks because banks specialize in loans for different use cases. To enable all of this, a platform had to be built for syndicated loans with the invitation process and contract negotiations. This is when the team saw the fundamentals of what blockchain technology enables in the space of syndicated loans.

The fundamental issue banks need to agree on is contract status. Based on this, Frøystad explains that the fall of 2016 is when they started to make a system for intention and agreement on contract status which made the whole negotiating process digital and gave the same rights to the involved financial institutions. This made it possible to define different roles by looking at what type of access they would need to the contract.

Putting the collaboration on a platform where you can view the history would benefit the banks in maintaining their relations. Using a platform you can get the complete history, build in reputation solutions and identities with ratings on previous loans, and you can easily do different searches. Frøystad elaborates that "you do not necessarily need blockchain to do this, but combining the creation of a platform where you can track the contract status, and at

the same time build out with payment solutions and potentially handle shared data in a better way is what blockchain enables". Frøystad also notes that if Evry actually were to make a product on this, they probably would not have chosen blockchain. In the proof of concept the team only focused on the possibilities of blockchain technology, and put everything you could on the blockchain, but they admitted that they most likely would not have done that if they were to launch this as a product today. One example of things they would have done differently according to Frøystad, is that in their proof of concept they put all the information from the contract on the blockchain, but one could also insert the hash to the blockchain, and store the document in an external database, and then have some sort of security that ensures that the file has not been changed.

Evry has not done an analysis of the project after it was finished. They never looked at trade-offs of using blockchain versus more traditional databases. They knew that the platform they used (Hyperledger) for the development was not ready yet, that it was not a mature technology, so a centralized solution would definitely had been better. It was more for research and getting experience in the field. Their customers would not care about the solution being based on blockchain or not because the most important part for them is the functionality. In Frøystads own opinion, it does make sense to use blockchain as the infrastructure instead of a centralized database. In a centralized database, you would need a neutral third party as the operator for all the syndicated loans in this case, and the banks would have to contact this operator every time they were going to create a new loan or change anything with the existing ones.

**Value propositions and competitive advantage**

Frøystad views their blockchain solution's main value propositions to be *decentralisation and sharing and restriction of information*. The sharing of information means that everyone can view the status on the syndicated loan. It provides information about how many are invited, if they said yes or no to contribute, how much money they are willing to invest, and if they are agreeing on the contract today, Frøystad explains. Evry's solution could be made with centralized databases too but most likely not as good, as the parties would have to agree on who has control over the centralized database and who gets to update it. In addition to sharing of information Frøystad is interested in restrictions as well. Restriction of information is an

important part in a collaboration between banks. Within the consortium no one would have more control than the other, so no players would be dependent on a central administrator to keep everything in sync, as an argument for having a decentralized solution that no one owns more than anyone.

Very few startups in Norway work on blockchain technology. According to Frøystad there are few in Norway with the knowledge on advanced cryptography needed to understand blockchain technology sufficiently. It is getting more intuitive to build applications on top of blockchain solutions, but according to Frøystad there are not many people in the world that could develop the blockchain protocol.

## 4.4 Case 4: Internet of things protocol

IOTA is a revolutionary blockchain specifically architected for the Internet of Things. It is the first open blockchain that is scalable with zero-fee transactions and data transfers for machine-to-machine interactions (Angel.co, 2017c). IOTA enables companies to explore new business models by making every technological resource a potential service to be traded on an open market in real time (IOTA, 2017). We interviewed David Sønstebø, founder of the IOTA Foundation. Sønstebø created the company from his vision of a machine economy and secure data through a distributed ledger technology. His role is to lead the project and create strategic partnerships.

**Background**

Sønstebø caught interest in the concepts of blockchain technology early on, in the sense that he was fascinated by the futurism in it. His interest was more for the technology itself than the ideological aspects of blockchain, and in 2012 he started working actively full time with blockchain. He recalls realising that "blockchain is just a database, and you can put anything you want into a database". He saw the uniqueness with blockchain being that it was a decentralized database, so you had full control in the sense that you can trust that the information you put in is not going to be changed by a third party.

In 2013 Sønstebø joined the project NXT, which was the first blockchain 2.0. It was the first blockchain that went past the transactions, and implemented stocks and voting on top of a blockchain. This was also the first blockchain that was based on a new consensus, proof of stake instead of proof of work. Through NXT, Sønstebø got to know the creator of NTX, Sergey Ivancheglo, and in 2013, Sønstebø started working actively with Internet of Things.

David points out that "one of the main reasons that Internet of Things (IoT) mainly consist of random bullshit on kickstarter.com is that this is what is easiest to make. If you are going to make things that actually work, meaning sensors that share data between them in a universal network, different companies have to collaborate, and that is always really hard to achieve". This is where blockchain comes in, in the sense that you remove the need for trust. You can guarantee safety and that the different actors are held responsible. In this natural transition IoT and blockchain can work in synergy. When Ivancheglo and Sønstebø continued and worked on a specific use case, such as distributed computing, they realized that blockchain is not scalable. The Bitcoin protocol can do 7 transactions per second and Ethereum can do about 1.3 transactions per second at the time of writing. This is not scalable in a global scale where billions of things communicate and interact with each other. This was the start of IOTA, which combines IoT with blockchain, and solves the scaling issues and the fees.

**About the company**

IOTA is technically not blockchain. It is a distributed ledger, but they have gotten rid of the blocks and the chain, since these are the bottlenecks of the traditional blockchain protocols. Sønstebø and Ivancheglo looked at the Internet of Things and blockchain, and realized that the principles behind them gives a good symbiosis, but there are big scaling issues and fee-issues with blockchain that needs to be solved. This is what IOTA does.

In IOTA when sending a transaction, data or instruction, the user will validate two earlier transactions that others have completed. Everyone does this, so instead of having two different parties (miners and users), the one party is doing both things. It has become an integral part of the network, so it also validates the network. This means that you do not have to pay any fees, because the incentives are already built in. You use the network, and thereby you also validate the network. This is the basis of the difference between traditional

blockchains and IOTA. IOTA has gotten rid of fees on transactions, and they have removed the scaling issues (Popov, 2016).

IOTA's vision is a machine economy, or economy of things. In a world where you have billions of different machines and things that communicate, sell data, bandwidth and computations to each other, you will need a network like IOTA that enables machines to trade with each other in a fully automated way. As Sønstebø states: "IOTA is made to enable an economy of machines and secure data for machines, because data is only valuable if you know that the data is correct."

**Process of choosing blockchain**

Sønstebø states that the team "definitely saw the problem before the solution". This was also one of the reason that made them wanting to solve the problem, because no one else was solving it. The IOTA team had the expertise, and thereby knew that they could do it. When starting out thinking about how to solve the IoT problem, the team knew that if they could solve the problem with fees, they could use a distributed ledger to secure the data. The problem with securing data with a regular blockchain is that for the average data package you would have to pay about 50 cents if you use the Bitcoin protocol, which is not scalable, since in IoT there will be billions of billions of transactions each day. The team knew that if it could solve the transaction fees with Bitcoin, it could be used for securing communication with cars, connected health care and basically all types of data. They were focused on getting the protocol to work, because they knew that all of these use cases existed for the blockchain technology, but it was physically impossible to create them without getting rid of the fees.

IoT mainly consist of huge amounts of data that gets generated, which information is extracted from, and then again acted upon. The data is only valuable if it is certain. A problem today is that there are large amounts of data put into central databases, and people hope that they will not be corrupted, and we partially trust it. However, there are numerous examples every year that databases like these gets corrupted, and the data gets changed. The consequences of this are clearly bad, especially in a world where everything from health to finance is 100% digital. This is where a distributed ledger could be used for access

management, since by using a distributed ledger you cannot change any parameters unless you have consensus.

Sønstebø identifies the reason for IoT being a hype is that there are few incentives for companies to collaborate with each other or share data. He exemplifies: “If you have a data centre with endless storage space and you have a data centre with endless computational power, there is no natural or organic way or incentive to share these technological resources with each other”. In the cloud you could get those incentives, but when it comes down to what is called *fog*, the new paradigm where the whole world is connected, you have no mechanisms or incentives for it - and the problem is that the transactions are very small. Therefore it was crucial for IOTA to get rid of the fees. When the fees are removed it finally creates an open ecosystem where machines can share resources and services with each other.

To sum up, fees have done very many things impossible. If the transaction is so small that you cannot make a profit of it, the transaction will never happen, leading to a lot of resources being stuck. IOTA gives an incentive and a mechanism to actually share the resources and at the same time enabling companies to make money from those resources.

**Competing blockchain technology**

Sønstebø states that the safety of IOTA is much better than its competitors. When you are validating two new transactions, this is directly two new transactions in the network, but the two transactions you validate again refers to two previous which refers to two previous and so on. This means when IOTA say that you are only validating two transactions, you are indirectly validating the whole network. Technically it is called a “directed acyclic graph”, but IOTA calls it the *tangle*, because the transactions are entangled with each other. The advantage with tangle over the Bitcoin blockchain is that with the latter you have mining pools - whose level of control over the network is linearly correlated with the amount of hashing power controlled by the mining pool. This means that if a pool reaches 51% of the hashing power of the network it could control it and take it down. With IOTA there are no mining pools. Sønstebø calls it “maximized decentralization” in IOTA, because you do not have a third party that validates.

**Limiting factors**

Sønstebø is clear on IOTA's main limitation; access to great developers. As stated earlier, IOTA is the underlying cornerstone of the whole project, but the vision is also to build modules upon it. For this, they will need new developers. Sønstebø says "finding good developers is very hard, because most good developers are not interested in money. For them it is more about being convinced about the technology, the vision, and why they should bother spending their time on it." Another natural barrier identified by Sønstebø is that they are fighting against a lot of noise. Since blockchain has become such a phenomenon, it is hard for companies to separate what is real and what is not - they do not have the expertise. As an open-source project, IOTA always fight against the big forces of the market, it is unavoidable according to Sønstebø. Those are IOTA's two biggest barriers or limitations.

# 5 Analysis

In this chapter we present the results of using our framework, first on the cases individually, then on a cross-case analysis which is the basis for our findings.

## 5.1 Within case analysis

We have searched for both internal and external resources within the case companies. In accordance with our framework, we have defined firm resources to "include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991, p.3).

### 5.1.1 Case 1: Blockstack - a new decentralized internet

Blockchain is the enabling technology of the solution Blockstack creates. Without blockchain, what they are doing would not be possible with currently known resources and methods. When creating a new decentralized internet, you want to be independent of trust between users, which is achieved through using blockchain. Since the entire solution Blockstack builds is open-source, it is questionable whether the blockchain technology itself or the code is valuable. Their code is publically available which increases the need for a competent team to build a robust product that is hard to maintain and further develop without the team. Blockstack has an experienced team of PhDs and experienced developers. The two founders are well known within the blockchain community. Muneeb Ali, PhD within distributed systems, has research papers with over 950 citations (Ali, 2017c), and Ryan Shea has been featured in Forbes 30 under 30 having authored several popular open-source cryptography and blockchain libraries (Shea, 2017b). Through their extensive work with blockchain technology, they have managed to perceive an opportunity, and exploited it, which is in accordance with Shane's (2003) definition of entrepreneurship. Blockstack currently has 7 employees, all with academically strong backgrounds, and about 12 interns working on master's theses and building applications for Blockstack. The combination of Blockstack's innovative solution with the highly competent and skilled team provides a competitive advantage (Han et al., 1998; Damanpour et al., 1989; Dierickx and Cool, 1989).

The new decentralized internet Blockstack has created will be dependent on adoption and people building applications on top of it. Blockstack has the opportunity and competence to build these applications themselves, and their network and recognition will help the adoption of their product. The team thereby enables optimal usage of their solution. In addition, there is a degree of tacit knowledge in Blockstack through the experience of the team and their unique knowledge as to how to utilize their technology. Causal ambiguity prevents imitators of knowing exactly what to imitate or what to do with the same resources that Blockstack has (Lippman and Rumelt, 1982), and this is the reason why Blockstack can provide all their code open-source. Even if their competitors would manage to gather the same resources (people, community, funding), which is highly unlikely in the first place, they would still not know how to utilize these resources in the same way Blockstack does (Reed and DeFillippi, 1990). In addition, as the imitability of Blockstack's solution depends upon the process of how it was accumulated (Dierickx and Cool, 1989), and the accumulation is a result of years of research and dedication working with blockchain technology for this exact use case, it would take competitors several years to catch up. Those years would at the same time be used by Blockstack to strengthen the competitive advantage they already have even more, thus maintaining the leading position they already have.

According to Stanley, Blockstack started out with the problem of decentralizing the internet, and it became their vision to create this decentralized internet. Thoroughly deducing the problem down to first principles, resulting in a better understanding of the aspects of the problem, contributed to making them more capable of solving the challenges associated. Due to Blockstack being a software company, competency within the field is what drives the product development. By recognizing your challenges you are able to map out the competency you would need to acquire in order to efficiently solve them.

Blockstack has published two papers; "Blockstack Whitepaper: A New Decentralized Internet" (Ali et al., 2017) and "Trust-To-Trust Design of A New Internet" (Ali, 2017a) written by Co-Founder Muneeb Ali, both reflecting solid knowledge within the field. Publishing this work shows that they are not afraid to share their knowledge because this knowledge, that is accumulated over a period of at least three years, is not easily adopted. Publishing their work enables others to verify, and it sends a message that they have

confidence in their work. Publishing their work, and having the whole project as open-source also enables others to contribute to the project, and there is a lot of tacit knowledge in the community that is being contributed to Blockstack through code reviews and applications built by the community. Blockstack itself also has tacit knowledge within its employees, which is the most important resource in the company. It is the combination of this knowledge and the understanding of blockchain technology that enables them to utilize blockchain as a resource.

The company has received over 6.79 million dollars in funding (CBinsights, 2017) from a total of 10 investors, including Union Square Ventures, Digital Currency Group and Naval Ravikant, all of which contribute with a large network which is door opening for Blockstack. Blockstack's resources have all arized from a combination of activities performed over time (experiences) and acquisition from the outside (12 interns working for Blockstack, and other employees hired), both reflecting prior managerial choices (Barney, 1991), and the team itself is hard to imitate and rare amongst competitors, thus considered a valuable resource. Combining the valuable resource of the team with the enabling technology, creates a strong competitive advantage.

**Summary of Blockstack analysis**

Blockchain is the enabling technology of Blockstack's solution. When creating a new decentralized internet you want to be independent of trust between users and service providers. This can be achieved through using blockchain, making it a valuable resource for Blockstack. The community around the Bitcoin blockchain is also a valuable resource for Blockstack (Dierickx and Cool, 1989). Building their open-source solution on top of the Bitcoin protocol, which is also open-source, enables the community to help out by pointing out mistakes and contributing on the code which again makes the solution more secure since everyone help finding errors. Their founders are experienced and well known in the community. The long experience of the founders enable them to be visionary and see the possibilities in the solution, while at the same time knowing what resources are needed to reach their goals. This has enabled them to put together a strong team and gathered 6.79 million dollars in funding from experienced investors, which together with the community enables them to utilize the decentralization concepts of blockchain. The resource

configuration with team, community and technology is a strong competitive advantage for Blockstack.

### 5.1.2 Case 2: Bernstein - intellectual property management

Intellectual property management is something that has been done for several years, although the traditional processes are highly manual, expensive and cumbersome. One could say that Bernstein competes with existing solutions like patents, trade secrets, defensive publishing, timestamps and private certifiers, but at the same time Bernstein simplify the process of getting a certificate for property rights. Bernstein's jump in technology could be compared to Netflix and Itunes regarding how they revolutionized renting of movies and purchasing of music. It is the effectiveness of Bernstein's solution, that gives them a competitive advantage towards traditional methods of securing ownership rights. Instead of having to go to a patent bureau to get drawings and similar stamped to say that you actually created these at this exact point in time, you can store a direct link to these drawings on the blockchain, which will make it undisputable whether as if you had these drawings or not at the time, because blockchain is immutable, which is how blockchain is used as a resource in Bernstein's case. The link is directed in a way in which you cannot modify the file after you have stored it on the blockchain, which proves that this exact file was in fact created, and has the attached timestamp. Doing this, everything can be stored each day on the blockchain with just a click instead of having to go physically to an institution to get it approved. The perceived benefits associated with Bernstein's solution could lead to a competitive advantage (Peteraf and Barney, 2003), but there are other companies building similar solutions as to what Bernstein does, proposing and offering almost the exact same solutions, with the same technology, so Bernstein does unfortunately not use blockchain in a way that will give them a sustained competitive advantage. They lack key surrounding resources of the blockchain technology, like community and extensive previous experience from using the technology.

Blockchain in their space is not a rare resource. The resources gathered from activities over time and through outside acquisition (Barney, 1991) are not valuable, due to being commodities, and can reflect bad managerial choices by not making sure the required resources for a competitive advantage are gathered. The number one reason for Bernstein not having a competitive advantage as of today, is the high competition to be a provider of the

kind of services Bernstein is offering. Competing firm's services are very similar. The high competition will even out the advantages (Peteraf, 1993), making it a self evident commodity in the future to use blockchain technology for this purpose.

Bernstein has several different assets that they can take advantage of. Their strongest assets lies in the team and their previous experiences. The team has been working with cryptography for almost 10 years, and blockchain for almost 2 years. Telefónica has funded the project with about half a million euros. Blockchain is another asset that Bernstein has the knowledge and competency to utilize. In his own words Berulli states that "A public blockchain is a new common, a new natural resource that is available to everyone, and one use of this natural resource is to establish a public registry", which is what Bernstein does. Bernstein's assets in the form of knowledge enables them to utilize blockchain as an asset. The resource is available to everyone, but it is how you can combine it with the knowledge of your team, tacit knowledge, and other resources in your company, that will decide whether you will get a competitive advantage or not. Through their previous experiences (10 years of cryptography, 2 years of blockchain and several previous startups), they have gained knowledge that only experienced entrepreneurs will have. This gives them a an advantage towards new actors that are entering the market. On the other hand, Bernstein does not have a community behind them that supports them, and that looks over their code, since Bernstein does not provide open-source code of their project. This lack of a community and network forces Bernstein to "work on their own", meaning that they cannot take advantage of a community in the same way other blockchain startups do. Community is an important resource that Bernstein is missing, but at the same time the community is not as essential for the type of solution that Bernstein creates. Bernstein does not create a two sided solution or a solution in which the value increases as a function of users. Their value for their users is the same, independent of the number of users.

The founders of Bernstein all have previous experience from startups or bigger firms. Paul Reboh has earlier been product owner for Fidor Bank, and Florian Weigand is former tech lead at Foodora, a successful international food delivery company. Barulli himself has worked with two previous startups, and has significant prior experience with bitcoin and

blockchain. Having prior entrepreneurial experience decreases the likelihood of failure and increases the chance of making beneficial managerial decisions (Shane, 2003).

All of the resources help create positive effects, but Bernstein misses a resource that will create a significant positive effect. Berulli has two years of previous experience with blockchain, but since he does not work on the actual implementations of the product, the value of his previous experience is greatly reduced, and since none of the developers implementing the software has previous experience with blockchain, this is a drawback for the company. Founders that has previous experience with the technology, understanding of it, and have worked on the implementations, create such a competitive advantage towards other blockchain startups not having founders with all of these skills, that it creates major drawbacks for those that do not possess the same set of skills.

**Summary of Bernstein analysis**

Bernstein simplify the process of getting a certificate for property rights, by utilizing blockchain as the enabling technology for their solution. Blockchain is tamper-proof, meaning that once something is on the blockchain, it cannot be modified. By creating a special link to a specific file, it can be proven that a certain file existed at a certain point in time, and that it has not been modified since. By combining blockchain's attribute of being tamper-proof, with the team's long experience with security solutions, Bernstein has managed to create a competitive advantage towards traditional methods of securing ownership rights. The high competition in the space will even out the advantages of Bernstein's resource configuration (Peteraf, 1993), making it a self evident commodity to use the blockchain technology for this purpose. Having a founder with only two years of experience with blockchain, while at the same time none of the team members working on the technical implementations have previous experience with blockchain, is Bernstein's biggest resource gap. This gap may make it harder to succeed for Bernstein than other more experienced teams. On the contrary, Bernstein has succeeded in getting funding from Telefónica - one of the largest telecommunications company in the world, which gives them credibility.

### 5.1.3 Case 3: Evry - syndicated loans

Evry has a large organization behind the team developing their blockchain solution. This enables them to allocate however many resources needed for the project, and then reallocate these resources and people when there is not that much work to be done. The team did this, and were at most 11 people working at the project, but there are only three people working on it on a daily basis. During Frøystads internship, he wrote a whitepaper on blockchain technology within financial systems, which proved to be a good asset to quickly get new team members up to speed with the technology.

Since Evry is a large corporation, their development projects can easily be funded by other activities in the company, and they are therefore not dependent on getting funding from external actors. Evry's existing customer database also enables them to get meetings with potential customers for their blockchain project. This close connection to customers also gives them good information about what areas of blockchain are interesting and needed for customers, which is a great advantage that many smaller companies will not have.

Evry is a typical case in which a big company wants to understand and get experience on a technology. Our interviewee, Frøystad, also acknowledges this, and tells us that as they are a consultancy firm, and as blockchain is getting more and more attention these days, they needed to build competency on the technology in order to be ready for future customer needs. As a result they needed to do a project which would increase their knowledge in the field, and not necessarily a project that they could sell. Evry competes solely on their competence, competing with other consultancy firms, and not a solution they have made. They are dependent on building competency on the blockchain technology, which they will leverage as a resource for projects with customers in the future. The stronger the competency and knowledge base, the bigger their advantage will become towards competing consultancy companies. As a result of their focus not being on the solution itself, but rather on the knowledge they would gain by building it, they ended up building a solution for a problem not necessarily dependant on blockchain. Evry themselves admit that they would not have used blockchain if they were going to make it as a commercially available product, but their goal was to learn, not creating a competitive solution to the problem.

The solution Evry ended up with is an okay solution to a problem, that could potentially have some benefits. On the other hand there are many similar solutions to the problem already, and the US company Symbiont (Symbiont, 2017) is working on a solution based on blockchain for the same purpose of syndicate loans. Evry does have an advantage in having a lot of prior experience working with syndicated loans, which gives them an advantage in creating the blockchain solution for it. At the same time Evry did not have an intention to build a product to be sold when they built it, they did not search for competitors and how to differentiate their offering from them. As such their product only becomes one out of many solutions to handle syndicated loans, without a clear competitive advantage (Han et al., 1998; Damanpour et al., 1989). In Evry's case there was a lack of people with long experience with blockchain in the team, and there was not a passionate visionary founder. This reduced the team's ability to see a clear problem to address, where blockchain technology would be beneficial or the enabling technology. However, as Wilk and Fensterseifer (2003) notes, a key attribute for superior resources is that they remain limited in supply, which today is the case for people with in-depth knowledge on blockchain technology. This limits Evry now, in that their competitors have a competitive advantage by leveraging their knowledge, but as blockchain knowledge becomes more commonplace the significance of this benefit will decrease and Evry will be more competitive. This indicates that the companies enjoying the competitive advantage with having access to superior know-how today, might experience this resource becoming less valuable, relative to competitors, as the general knowledge increases.

**Summary of Evry analysis**

Evry has a large organization behind the team developing their blockchain solution. This enables them to allocate resources needed for the project, and then reallocate these resources and people when there is not that much work to be done. The large organization also comes with other benefits, such as having a large customer database that makes it easy to get meetings with potential customers of their blockchain solution. Evry is a typical case in which a big company wants to understand and get experience on a technology. As blockchain is getting more and more attention these days, they needed to build competency on the technology in order to be ready for future customer needs. Their project was therefore chosen as something that would increase their knowledge in the field, more than being a solution

they aimed to commercialize. Evry competes solely on their competence, competing with other consultancy firms, and they therefore have to build knowledge in the blockchain space through a blockchain team, which will be a resource for the rest of their organization.

### 5.1.4 Case 4: IOTA - IoT protocol

Blockchain is the underlying technology inspiring the distributed ledger technology that IOTA has created. What IOTA has managed to create is technically not blockchain anymore, as they have removed both the blocks and the chain, but in this context, the term blockchain is used in a wider sense to cover all technologies building on the underlying fundamentals of blockchain. Since IOTA has created their own version of blockchain, it makes it a strategic and rare resource. This way, their blockchain solution becomes a valuable resource, even though it is open-source. Their unique know-how on how to use it, gives them a distinct advantage compared to competitors (Reed and DeFillippi, 1990), which would have to build a team of the exact same skill group to be able to use the technology. The combination of their unique technology as a valuable resource and the team being hard to duplicate, gives IOTA a clear competitive advantage (Damanpour et al., 1989; Dierickx and Cool, 1989). The blockchain technology IOTA creates is also a valuable resource in itself, providing the competitive advantage of not having any fees on transactions, and that they have more transactions per second compared to other blockchain protocols. The way IOTA scale, is that since you are validating two earlier transactions, it means that you validate more than you use. This way, the more users, the faster the IOTA network becomes.

IOTA is open-source, meaning that everyone can copy the code. But to recreate IOTA you would have to recreate the whole team, and you would have to recreate all the companies IOTA are working with. This is what decentralized technology is about; it is dependent on adoption, and you need many users for the network to work. Since IOTA started in 2015 they now have 100 companies that are involved. Sønstebø acknowledges that adoption is hard to create. He estimates you would need about 20 years of experience within cryptography, 10-15 years within programming and mathematical skills to create what IOTA has created.

According to Shane (2003), entrepreneurship is a process in which an individual perceives an opportunity to make money and then exploits it. Sønstebø did exactly this when he set out to

create IOTA. He saw that there was a need for a fee-less blockchain, with higher transaction throughput, and without the need of miners, through his previous experiences with the blockchain technology. He knew he needed a strong team to create his vision, and thus gathered a highly competent team, proving to be a great asset for the company. In accordance with Alvarez and Busenitz (2001) the opportunity Sønstebø seized, existed because the different agents within the blockchain community had different beliefs about the relative values of the blockchains (as resources). IOTA owns an undisclosed amount of IOTA tokens and by letting people invest in buying these cryptocoins the value of the company rises. This value is being used to fund the development of their technology and lets the company produce a significant positive effect (Massey, 2016).

IOTA has shown a great ability to acquire strategic partnerships. As the technology is open-source, the need for a strong community and customers invested in the platform is evident. Through the founders' online appearance IOTA has acquired a large online community of supporters and developers. The type of solution that IOTA is building requires both a large community and many partnerships, which are considered resources needed to complement the technology to make it valuable, as the technology in itself is open-source and therefore not of particular value. IOTA has managed to create a large community, which has resulted in an extensive value network.

IOTA was the first project without a price for founders, meaning that the founders had to buy tokens on the same premises as everyone else. Their generosity has payed off by getting help through the creation of a community not driven by IOTA. A imperfect mobility like this community is very hard to imitate for competitors, thus creating a competitive advantage for IOTA (Peteraf, 1993). Creating such communities, or having the luxury of others creating them for you, are essential in order to gain adoption of the service, and turning the product successful. Just as the value of having a phone is strongly connected to the number of other users having a phone, the value of IOTA and its service is greatly correlated with their number of users.

The IOTA founders and team definitely sit with information not open to the general public. They have partnerships with companies like Microsoft, Daimler, and Bosch, which gives

them information about what kind of products they will introduce to the market in the future. At the same time the IOTA team is involved in the cryptocurrency movement and therefore has a good picture of what exists and what is happening in the ecosystem. Their previous experiences, and therefore information regarding what works and what does not, also gives them a clear advantage towards more inexperienced blockchain startups.

IOTA possesses unique knowledge and competency within mathematics, cryptography and distributed ledgers. These resources has arised as a combination of activities performed over time, and acquisitions of the resources from the outside when needed, which is in accordance to how Barney (1991) describes how resources arise as a reflection of prior managerial choices. The unique resource configuration of IOTA has made it such a promising startup that their token (coin) became the 6th most valuable cryptocurrency already on its first release day, June 13th 2017.

**Summary of IOTA analysis**

Blockchain is the underlying technology inspiring the distributed ledger technology that IOTA has created. Since IOTA has created their own version of blockchain, which outcompetes other blockchains by removing transaction fees and enabling more transactions per second, it makes it a strategic and rare resource. This way, their blockchain solution becomes a valuable resource, even though it is open-source. Their unique know-how on how to use it (20 years of experience within cryptography and 10-15 years within programming and mathematical skills) gives them a distinct advantage compared to competitors (Hayes et al., 1996; Reed and DeFillippi, 1990). Through the founders' online appearance, IOTA has acquired a large online community of supporters and developers. These resources are required to create the type of solution that IOTA has built, and they have resulted in an extensive value network. With several of the founders coming from the community, IOTA has had close relations with the community since day one. The founders have previous experiences in building solutions on a blockchain, giving them a clear advantage towards more inexperienced blockchain startups. The unique resource configuration of IOTA has made it such a promising startup that their token (coin) became the 6th most valuable cryptocurrency already on its first release day, June 13th 2017.

## 5.2 Cross case analysis

For all of our cases, blockchain is the enabling technology of the services they create, except for Evry, where their solution in its current form could be done without blockchain. Evry primarily wants to get experience and understanding on a technology, not necessarily commercialize, and it is in that sense different from the others. All of the companies have great advantages of utilizing blockchain as a resource, but it is the combination of blockchain with the firms' other resources that creates their competitive advantages (Dierickx and Cool, 1989). Blockstack and IOTA both have large communities supporting them, and help them with their open-source code, providing an invaluable resource for the companies. They both also have strategic and helpful partners. Bernstein and Evry's employees and founders both lack long prior experience of working with blockchain solutions and there is competition on their position in the market, which is a big challenge for them in getting a sustainable competitive advantage, due to the anticipated returns of their positions will be competed away (Peteraf, 1993). IOTA and Blockstack on the other hand both have experienced and visionary founders, which have enabled them to see solutions to problems previously not solved, and helped them gather strong teams. They are also in a superior position in that they were visionary and claimed their market position before normal competition occurred, and they are thus in a condition for competitive advantage (Peteraf, 1993).

### 5.2.1 Visionary founders are important for competitive advantage

Through our case studies, we understood better the value of visionary founders. Much about blockchain is about realizing what the technology can do. Founders with previous experience, that at the same time are visionary, will understand what the technology is capable of and also envision future use cases. With the blockchain landscape and associated market opportunities being unexplored and having this level of uncertainty, a degree of visionaryness, foresight, or luck is required to establish a superior position (Peteraf, 1993). The ideas and solutions that comes from these founders will in general be more sustainable and it is much easier for these companies to create a sustainable competitive advantage.

**Experience with blockchain increases opportunity recognition**

It is the previous experience of the team that enables them to see problems that can be solved with blockchain. In all cases the founders claim that the problem came before the solution. This is correct to some extent, in the way that a product not was created or technology developed, and then one started to look for a market/problem fit. On the other hand, it is the founder's previous experiences with the technology that enabled them to see the problems that could be solved with the technology and the solutions that they provide. In the three cases Bernstein, IOTA and Blockstack, all solutions solve problems in a way that is only possible with blockchain technology, to our current knowledge. It is their previous experience with blockchain that has given them the knowledge required to perceive an entrepreneurial opportunity and made them act upon it. This is in accordance to Hayek (1937) and Vaghely and Julien's (2010) perception of entrepreneurs' ability to recognize and act upon opportunities that objectively exists in equilibrium, only by an information surplus are you able to perceive of an entrepreneurial opportunity. If the team does not have enough prior experience with the technology, the solutions they come up with may not be adequate solutions to problems that require blockchain. In this case we see that the solutions provided do not have clear competitive advantages, as opposed to solutions proposed by founders with several years of experience.

In the case of Evry, Frøystad says that they would most likely not base their solution on blockchain if they were to make a profit off of their product. This may reflect that a large company such as Evry lack an entrepreneurial spirit in their approach to product development. It could also reflect Frøystad's lack of prior experience with both entrepreneurship and blockchain technology as entrepreneurship is a process in which an individual perceives an opportunity to make money and then exploits it (Shane 2003). On the other hand, Evry's project was not started on the basis of making a profit, but rather to acquire competency within the domain of blockchain in the belief of being able to profit off of the competency in the future.

### 5.2.2 Employee know-how is the most valuable resource for blockchain companies

Through the interviews with blockchain companies, it was found that finding the right, competent people, is the limiting factor for growth. In order to grow, there is a never ending need for good developers. According to Sønstebø, average salary for a blockchain engineer is about 300 000 dollars "simply because companies are desperate for talent since there's so few of them". Frøystad agrees to this and says there are very few that actually understand blockchain in the degree of developing the bottom layer (protocols). In Sønstebø's experience most good developers are not interested in money. For them it is more about the technology, the vision and why they should bother spending their time on it. As blockchain is such a new technology, there are very few people in the world with long experience of using the technology. As such, the researchers found that people with long experience with blockchain currently is a superior resource that currently is in limited supply and provides a competitive advantage (Hall, 1993; Peteraf, 1993). The only way to get this resource is to either hire someone from another company, or by building the competence within the firm, which have taken Blockstack over 4 years. Even though it takes a lot of time and effort to build competency within the firm the resource is still imitable, meaning that the firm cannot achieve sustainable competitive advantage on this resource alone (Wilk and Fensterseifer, 2003).

As competency is the most scarce resource it follows that employee know-how is the most valuable resource in the blockchain domain. Resources only have the potential to give rise to economic value if they are used to do something (Barney, 1991). Without the employee know-how of how to create the resource (blockchain) there is therefore no value in it. This explains the importance of having the right team, and why know-how is the most valuable resource for blockchain companies. This is also supported by Hall (1993) that showed through case studies that know-how is one of the most important contributors to business success. The core team in Blockstack, Bernstein and IOTA all have good competency within the blockchain domain, either as prior hands on experience, higher level education within computer science and distributed systems, cryptography or a combination. IOTA and

Blockstack, which is creating the most advanced product of the cases, are both frequently looking to hire talented developers. Evry, which is an exception in that they lack prior knowledge and extensive experience, has realized that blockchain might have a huge impact in the future and are developing a blockchain based platform with the sole purpose of enhancing Evry's competency with blockchain technology. They have identified that blockchain is a subject that requires tacit knowledge and want to build this competency by having their own project to gain know-how with the objective to get a competitive advantage and be the main provider of blockchain consultancy in the future (Peteraf, 1993).

By sharing the companies' knowledge through publications they are able to show the company know-how, which is the most valuable resource. Blockstack has released one paper, one PhD thesis and one whitepaper so far. These publications show how their technology works through simulations and explains mathematical principles behind the technology and enables whomever to investigate their core technology and to challenge their knowledge within the domain. This increases credibility and builds trust in that their technology is what they promise. Even though anyone, in principle, can copy their solution it requires deep understanding of complex topics and a team with the same resource configuration as Blockstack has today to be able to use it for anything useful. IOTA has released one whitepaper that explains the mathematical principles behind "the Tangle" - their blockchain inspired technology - which, similar to Blockstack, invites anyone to challenge their concept, know-how and "trade secret". For a machine-human economy it is crucial to build credibility and this is one way of doing that. Evry has published a whitepaper that describes the basics of the technology in general and its future applications. As financial institutions are Evry's customers, together with the fact that blockchain is referred to as a disruptive technology in the financial sector, it builds credibility to have a whitepaper about the technology published. This shows that Evry has knowledge about the technology. As of today, they have not benefited from this yet.

### 5.2.3 Creating a cryptocurrency token may increase value

Both IOTA and Blockstack are releasing their own cryptocurrency, or token, that can be used on their platform. IOTA created their token, iota coin, in 2016 and sold all of them through a crowdfunding event to about 600 investors including the IOTA Foundation. IOTA holds an

undisclosed amount of these tokens, that are now being released through an initial public offering (IPO) June 13th. Until May 26th, these tokens has been sold over the counter by shareholders and according to the last trading price, IOTA's market capitalization is 549 million dollars (Iotaprice.com, 2017). They can sell and capitalize on these tokens which they can use on further development of the technology. At the same time they also get more tokens in circulation within the created economy. According to Barney (1991), the tokens can only gain economic value if they are used to do something, and as of today, the tokens can not be used for anything other than being exchanged. The value is a function of the demand for the investment, and the expectations of what the valuation will be in the future. This makes it an extremely volatile currency and if the investors of the token lose their belief of IOTA being a success, their value will implode (Peteraf and Barney, 2003).

The positive effects of having your own crypto currency, is that you get your users to invest through buying the currency, which goes directly into funding the company. This is a clear competitive advantage, getting users to fund the whole project without needing external investors or giving up equity. This way, a crypto currency can be a strategic resource to a blockchain company in that they create a significant positive effect (Massey, 2016), and increase the perceived value of the company's products (Peteraf and Barney, 2003). However, combining this resource with other resources may strengthen the competitive advantage relative to competitors' usage of the resources (Prahalad and Hamel, 1990), which is what IOTA achieves through its coin release by, in addition to raising capital, attracting new members and growing their community.

### 5.2.4 The open-source blockchains might be a valuable resource by itself

The algorithm of a blockchain product is usually used to solve a problem, hence having the ability to give rise to economic value (Barney, 1991), but as discussed in section 2.2.2, blockchain as a representation of the computer algorithm, in itself, is not a valuable resource due to its open-source characteristics where it is equally available for anyone to copy the code (Massey, 2016; Barney and Mackey, 2005). Sønstebø explains that the algorithm for NXT was copied by a former employee, at the time he was working there, who made a similar product. On the other hand, IOTA uses the distributed ledger technology to create an economy between machines and humans where it is crucial to share the code. In their case,

the purpose of being open-source is so that various unbiased sources have the ability to verify that the code is safe, secure and free of corruption. If the algorithm was not publicly available one would have to trust that a centralized authority - the IOTA Foundation - does not have the ability to, for instance, create more tokens. Trusting a centralized authority would also defeat one of the purposes of blockchain technology, which is to distribute authority. Thus having the code open-source creates a significant positive effect on the companies - in that of gaining trust in the market and is by that definition indeed a strategic and valuable resource (Peteraf and Barney, 2003). It can also be argued that it is the open-source protocol, and the purpose it is utilised for, that initially attracts employees and investors. In this way, it can also be argued that an open-source blockchain is a valuable resource by itself.

### 5.2.5 Community building has a double positive effect for platform based blockchain projects

A community can be a valuable resource for certain blockchain startups, while for others, this aspect does not make any difference to the company's offering (Peteraf, 1993). IOTA and Blockstack are both dependent on adoption to make their solutions valuable to their users. Their products can be compared to that of a phone; a phone network with very few users is not very valuable, but as the number of users grow, the network becomes more and more valuable for the users. However, our finding shows that there is another aspect making the net effects of community building even greater for blockchain projects. One effect is the obvious increase in user mass, and for platforms; user experience. Community building can be seen as an imperfect mobility resource, being more valuable within the blockchain firms that built it, than for other firms (Peteraf, 1993). An increase in users is, for IOTA, correlated with an increase in the network's processing speed. The network effects of certain blockchain projects are therefore greater than for equivalent platforms not utilising blockchain technology. Not only do they affect both the user experience and access to products offered on a platform, but also the core technology through increasing security and transaction speed. Community building has therefore a double positive effect for platform based blockchain projects, and is thus a valuable resource and strategic resource (Massey, 2016). We see the community building process not only as a valuable resource, but also one of the main resources leading to competitive advantage for IOTA and Blockstack. Blockstack builds a

new decentralized internet, but without users and someone uploading content to this internet, it will be close to useless and not provide much value. In a similar way the number of transactions the IOTA network can do per second depends on the amount of users trying to do transactions at that instant. The more users, the faster the transactions will be. Another aspect of a community is that it creates a loyalty between users and the company, making for instance the community surrounding IOTA more valuable to IOTA than for any other company, thus contributing to a sustainable competitive advantage (Peteraf, 1993; Wernerfelt, 1989).

For Bernstein and Evry on the other hand, community is not as essential for the type of solution they create. Bernstein does not create a two sided platform or a solution in which the value increases as a function of user mass. The value for Bernstein's users is the same, independent of the number of users. Also for Evry's solution, the value experienced by every single user, is unaffected by the number of other users. For Evry the value is not user related but related to the knowledge gained through the project.

### 5.2.6 Different use cases need different resource configuration

As seen in section 5.2.5, some blockchain solutions are dependent on a community, while others are not. These types of startups are often identifiable in that they provide their code open-source to gain trust in the community. There are also other benefits of providing the code open-source, in that there is a lot of reviewers of the code, which means that bugs and security issues quickly will be found. In a similar way, section 5.2.3 shows how the creation of a cryptocurrency token may greatly increase the value of a company and be a lucrative resource in getting "free" initial funding for the company (Barney, 1991). Although both of these resources create value for some startups, they are not useful or applicable to all blockchain startups. For example, it would not make sense for Bernstein to create their own cryptocurrency, as all payments are going between a user and Bernstein. Creating a coin in between would only create overhead. In general, we see that different use cases for blockchain need different resource configurations to succeed (Hall, 1993).

Blockstack and IOTA are more decentralized than Evry and Bernstein's solutions. The decentralization makes both Blockstack and IOTA dependent on a community for creating

content and interactions in the two sided platforms, but for IOTA the users also provide a vital service in the technical solution, thus being a critical resource (Wernerfelt, 1989) to IOTA. Evry and Bernstein, on the other hand, are not dependent on having a lot of users. For Bernstein the value for a customer is the exact same if there are 1 or 1000 users using Bernstein's product, meaning that users are not a resource for Bernstein, other than that they are the ones that provide the revenue.

Partnerships are also a critical resource for some startups while not being essential for others. For Blockstack, who are building a new decentralized internet, it is essential and critical that they get partners that will create content on their web. Without content, Blockstack would just provide an empty internet, which is why they have hired several summer interns to create such content. In a similar way, IOTA is dependent on big actors in IoT starting to use their product to create value on the platform, and this is the reason they have created over 100 partnerships. The amount of content and number of partnerships are directly related to the value provided by IOTA's and Blockstack's platforms.

### 5.2.7 Process of choosing blockchain technology affects competitiveness

We have observed that the underlying processes for choosing to use blockchain technology to solve a specific problem were comparable for our cases, and were also a factor affecting the value of the technology and thus competitiveness of the company (Peteraf, 1993). Evry's process was driven by access to a technology and search for a problem to solve it with. The underlying goal was to increase in-house competency on the technology, but also to potentially commercialize a blockchain solution. However, as stated by Evry, they would not use blockchain technology to solve the problem they found through their process. This shows that the process was deficient and the factors Evry lacked in their process resulted in blockchain *not* being utilized in a valuable way and *not* giving the company a competitive advantage as of today (Peteraf, 1993), but in comparison with other consultancy companies they have gained a head start into a possible future market demand that could lead to a competitive advantage (Hall, 1993; Peteraf, 1993).

IOTA, Bernstein and Blockstack had similarities to their processes. Visionary founders were the base of the process, and they had all prior knowledge to technical aspects surrounding

blockchain technology. This gave them a technological insight and know-how which we have found to increase the chances of finding a compelling use-case for blockchain and gaining a competitive advantage (Peteraf, 1993). They were also involved in projects where they experienced problems they saw could be solved with blockchain technology, thus recognising an opportunity based on prior knowledge. Our findings suggest that this is a factor that enables the companies to utilize blockchain technology in a valuable way that contributes to the company's competitiveness (ibid).

## 5.3 Answers to research questions

### 5.3.1 What resource configuration must a company have access to in order to make use of blockchain as a resource?

The findings show that even though blockchain in itself is a resource, there are both internal and external factors that must be in place for it to become a valuable resource for the firm. Important internal factors are found to be visionary leaders and employee know-how. Community building is found to be an external factor enabling blockchain to be a valuable resource.

The blockchain technology is a source for the firm to gain trust from customers and users, in that it is generally open-source and trustless in its nature. However, in order to make use of blockchain as a resource, and with the high level of uncertainty related to the technology, the company needs to have great foresight in the possibilities of blockchain technology. Our findings suggest that a visionary founder is an important resource to be able to navigate in the uncertainty of what blockchain technology enables. With everyone having access to the technology through open-source blockchain protocols it is essential to have a leadership with foresight to stand out and claim a superior position in the market (Peteraf, 1993). We have found the same argumentation for community building and it is an important factor for blockchain platform projects. There are obvious reasons for a firm to gain positive effects from a solid community; higher reach, more engaged users and better user experience through higher throughput of products or services on the platform. However, our findings suggest that in addition to these positive effects there is another layer of effects special to

blockchain platform companies, that strengthens the argument for the importance of community building for blockchain to become a valuable resource. The number of users directly affects the product or platform through the effectiveness and security of the protocol which enables each user to verify other transactions. The value proposition of the technology, and not only the perceived value, is directly affected by the number of users or size of community. The community can also contribute to the open-source product, incentivized through tokens issued by the protocol to which they contribute. This makes community building an important resource, and it is a crucial in the resource configuration in order to make use of blockchain as a resource and to gain a competitive advantage over competitors with access to the exact same technology (Wernerfelt, 1989).

The firm must also possess a certain level of employee know-how, not only to be competitive but in order to make use of blockchain technology as a resource. Know-how within the nascent domain of blockchain is today a scarce resource, and is thus valuable to firms. With everyone having access to the blockchain core technology, the requirements for know-how and knowledge increases to be able to use it to gain competitive advantage.

### 5.3.2 What underlying processes are behind the choice of blockchain?

Our findings suggest two different approaches for choosing to utilize blockchain technology to solve a problem: (1) technology as starting point for seeking a problem to gain knowledge on blockchain, and (2) technology knowledge and problem experience as a foundation to build a solution with blockchain.

We have found that the process is closely linked to the competitiveness of the firm. Evry, through process (1), has not found a convincing use case for blockchain, stating they would choose another technology to solve the problem if they were to commercialize. We see a strong link in the process of choosing blockchain to the lack of competitiveness for Evry's solution. With blockchain being relatively hyped and the technology being open-source, there are numerous startups trying to find use cases for blockchain with basis in the technology. However, as previously stated, to find a compelling use case you need internal factors in addition to the technology to foster a competitive environment. This is what we see with the process of choosing blockchain for IOTA, Blockstack and Bernstein. Common features with

their processes is that they are lead by visionary founders who themselves have experience with the technology from before the term blockchain became a hype. Additionally, these founders have managed to attract talent and so increase the know-how of the team - another important aspect of the process. We see that these teams are knowledgeable about the underlying technological aspects of blockchain, such as cryptography, and they also have experience working in fields where they see how blockchain would be applicable. This is, as opposed to Evry's process, a process where prior knowledge and relevant experience with a problem leads to the choosing of blockchain as a part to solve that problem. Our findings suggest that this is a source to finding a compelling use case that can give the company a competitive advantage.

Another aspect related to the processes of choosing blockchain, is that core competencies and knowledge is an aspect of heterogeneity that may provide the direction for growth of the firm (Prahalad and Hamel, 1990). However, the market adoption of blockchain is in its infancy, so the market has not had a feedback loop to the product and service providers to give a market pull and indicate a direction for further development. This pull is what would indicate what is a valuable service for consumers. It can therefore be argued that the providers of blockchain services are the ones deciding what is to be perceived as valuable, at this time.

# 6 Discussion

## 6.1 The contribution of key findings to previous literature

In our literature review, we discovered that there is a lot of literature describing all the theoretically possible use cases for blockchain (Bjørnstad et al., 2016). As addressed in our introductory chapter, there is a lack of literature going in depth on the value creating aspects of the technology. Below, we are addressing entrepreneurial opportunities and challenges, and the value of blockchain in an entrepreneurial context.

### 6.1.1 Entrepreneurial opportunities

The literature review revealed several different use cases for blockchain without a discussion on how these act as an entrepreneurial opportunity (Bjørnstad et al., 2016). We are under the impression that the literature needs to address the foundation behind the application area as an opportunity since the successful application areas are yet to be verified. We do not know whether or not we have studied any of the prevailing use cases for blockchain in this study, but we believe we have discovered aspects that are necessary to identify favorable uses of blockchain. We have found that extensive experience and knowledge with distributed ledger technology is highly correlated with identifying problems that needs a technology like blockchain to be solved in an auspicious manner. Further, visionary entrepreneurs has a tendency to find future or near future problem scenarios that requires solving. These factors increases opportunity recognition that may pay off in the future (Peteraf, 1993).

We found that creating a cryptocurrency token is an entrepreneurial opportunity. It enables to raise funds for the company, without giving up any shares, through selling tokens via initial coin offering (ICO). Because tokens are made in limited supply, prices are determined by their demand. The popularity of investing in cryptocurrency is increasing, leading to prices of popular tokens increasing too. These findings contribute to the literature in further understanding the entrepreneurial space of blockchain, by suggesting and specifying what resources are the basis for potential use cases to be successful applications where blockchain adds value.

### 6.1.2 Entrepreneurial challenges

Another gap in the literature found through the literature review was a lack of articles describing the entrepreneurial challenges concerning how to make compelling use cases for the described opportunities enabled by blockchain technology (Bjørnstad et al., 2016). Concerning entrepreneurial challenges, the authors found a lack of case studies on blockchain companies studying the challenges linked to opportunity recognition within the blockchain domain and processes among companies utilising blockchain.

As stated one should have extensive prior knowledge and experience with blockchain to increase opportunity recognition, but this can be paradoxical in that the technology is still nascent and one can argue that no one truly understands the technology in terms of entrepreneurial opportunities on a long term basis. We have found that the tacit knowledge with the technology, which gives a competitive advantage, takes time to build and those who have good knowledge today will have an edge over those who start today. Another entrepreneurial challenge found is that the technology is in a hype bubble. It is said to be hard to stand out in the crowd as a serious actor when there are so many projects concerning blockchain. Take Evry as an example, who states their motivation for the project is to learn and not make a profit. These findings contribute to increase the knowledge regarding processes and their impact on competitiveness in companies utilising blockchain, but further investigation is needed to discover other processes and further map the effects on the company's competitiveness.

### 6.1.3 Value of blockchain as a resource

It is found that the literature concerning blockchain focuses on the implication of blockchain having the characteristic of being a decentralized technology, in that it removes the need for trust. There is a lack in describing what concrete contribution the technology have to the competitiveness of the firm (Bjørnstad et al., 2016). During the case study, the researchers found that using the blockchain technology itself does not necessarily lead to competitive advantages, but it is what it enables that can lead to advantages. In other words, blockchain enables companies to solve problems that could not be solved without it. By utilizing these

new capabilities of blockchain it can be a valuable resource in combination with other resources and lead to competitive advantages compared to existing solutions of similar problems.

In our study we have thoroughly studied blockchain as a resource by itself and combined, and by that have contributed to the literature regarding the value of blockchain as a resource.

# 7 Conclusion

The authors of this master's thesis have investigated how blockchain, together with other resources, contributes to the competitiveness of the firm. Our findings in the study has shown that blockchain technology is interconnected with other resources and that the competitiveness of the resources is reflected through the process of choosing the technology.

The findings show that even though blockchain is a resource by itself, there are both internal and external factors that must be in place for it to become a valuable resource for the firm. The most important internal factors are found to be employee know-how and founders with extensive prior experience. Employee know-how concerns implicit and tacit knowledge. Even though these resources are valuable, the configuration of resources may vary. Community building is found to be an external factor that also enables blockchain to be a valuable resource. For open-source blockchain solutions, a community allows potential users or customers to influence the development of the solution and test it. It is the company's ability to attract users that makes the technology valuable, both in terms of user experiences and the technology itself. It requires a skilled team to develop a solid product in order for the company to get a positive effect out of a community. Strategic partnerships are also found to be a critical external resource for blockchain companies that have a two-sided platforms reliant on content in order to attract users.

Our findings suggest two different approaches for utilising blockchain technology to solve a problem: (1) technology as starting point for seeking a problem to gain knowledge on blockchain, and (2) technology knowledge and problem experience to build solution with blockchain. The process of choosing the technology is closely linked to the competitiveness of the firm. The researchers found that companies with visionary founders tend to have a problem first - technology second approach, and they utilize blockchain technology to solve problems where blockchain is an essential part in order for it to be solved. This provides a competitive advantage where the competition is limited and competency is scarce.

While the above statements show resource configurations and processes favorable for competitive advantage, it should be noted that every company is different, and what works for one company may not work for another. The resource configurations leading to competitive advantages will help companies to find sustainable competitive advantages that fit their needs, but there are no guarantees that the proposed configurations are ideal.

There are both internal and external factors affecting the competitiveness of the companies, and far more than what has been investigated in this study. Our findings are indications for important resource configurations for competitive advantage, where some resources are emphasized based on the findings from our four cases.

This study contributes to bridging the identified knowledge gap between potential application areas of blockchain and the necessary resource configuration enabling a firm to utilise blockchain as a resource for that application area. Specifically, we extend research on competitiveness of the firm through utilising blockchain together with other resources, and also identifying the underlying process for choosing blockchain as a solution.

By applying our framework to analyze how companies are utilising blockchain, together with other resources, for competitiveness, we demonstrate the relevance of the resource configurations. To the best of our knowledge, this is the first study that explicitly investigates resource configurations for competitive advantage for companies utilising blockchain technology.

# 8 Further studies and implications

Through this research on blockchain technology, and analysis of different companies utilizing it, it is believed to be a connection between the value of the solution the companies provide, and what kind of features of the blockchain technology the solutions utilize. To be more precise, the researchers believe that blockchain technology utilized on problems that do not need blockchain to be solved in the first place, will result in solutions that are less competitive than the ones not utilizing blockchain. The researchers believe that blockchain only is right to use when it is needed for the solution to work, that is when no other technology will make the solution work, or when it would be very difficult to use other technologies. A research going deeper into whether this is actually the case is suggested.

Another topic for further research is whether using blockchain technology in a startup attracts more investment and press than using other technologies to solve the same problem. Just like AI and Big Data were buzzwords a while back, blockchain has become one now. There are more and more startups that take use of the technology, but we see that many of them are not using the technology for problems that actually need blockchain's distinct features. This is believed to create poor solutions, but we do not know for sure whether it will give the companies more funding and press to use the blockchain technology. If this is the case, using blockchain technology can create a "head start", with publicity and funding. Thereby startups can create barriers to competitors both in the sense of using the complex and futuristic technology of blockchain, which is hard to gain experience on and imitate, and in the form of getting money and press early. The theory is underpinned by the interview of Marco Barulli from Bernstein, where he states that; "As an entrepreneur with a blockchain startup you can benefit a lot from the hype…". We see signs of blockchain being used by many startups as a deliberate marketing strategy, building up an image that the startup has high competence in a superior technology.

To better understand the different topics of blockchain, how it functions as a resource today and provide value to today's solutions, we recommend that one should not have a predictive focus in publications on blockchain, but rather observe the technology in the present. By

shifting the focus from informative or predictive research and general descriptions of potential impact, to evaluation research where one examines the implementation of blockchain technology in practice and from there evaluate the implications, we believe that the opportunities and challenges associated with the application areas, and thus the entrepreneurial implications, will be better illustrated.

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# Appendix A: Interview guide for case companies

**General information**

1. **Background**
    a. Names and backgrounds
    b. NTNUs School of Entrepreneurship
    c. What are we writing about? Short
        i. We are writing an entrepreneurial master, where we investigate how companies are utilizing blockchain technology.
2. **Practical information**
    a. Why are the case company of our interest?
    b. Who is doing the interview and who is observing?
    c. Permission to record and transcribe - what are we using it for?
    d. Inform that some questions may overlap

Do you have any questions regarding the interview? Whenever you are ready we will start the recording.

**Transitioning questions**

1. **Interviewee**
    a. When were you first introduced to blockchain?
    b. What is your experience with blockchain besides this project?
2. **Company**
    a. Please tell us about your company
        i. What problems are you solving?
        ii. Why was it founded?
        iii. Have you received any funding?
        iv. Do you have any *operation revenue?*
        v. What is your business model?
        vi. What is your role?
3. **Employees**
    a. How many employees and what are their backgrounds?

**Key questions**

1. **Blockchain**
    a. Can you please take us through the process of choosing blockchain as your core technology?
        i. Why blockchain?
        ii. Was there a strategy involved?
        iii. Who was involved in the process?
        iv. What characteristics of blockchain is what makes it valuable?
            1. Decentralized? / Immutable? / Transparent?
        v. How is blockchain an essential part of your solution?
        vi. Is blockchain any part of your business model? How?
        vii. What value propositions does it deliver to your customers/users?
        viii. Have you considered a solution not based on blockchain?
            1. Why not?
    b. What reasons are important for you in choosing a blockchain based solution?
        i. What value(s) does it deliver your company?
    c. What do you consider as your constraints for growth?
        i. Time? / Funding? / Development? / Execution time?
    d. What do you consider your competitive advantage(s)?
        i. Technology? / Know-how? / Market knowledge?
    e. What is required to do what you do?
        i. What is "easily" done and what is hard to copy/imitate?
2. **Competitors**
    a. Who are your main competitors/substitutes?
    b. Do they use blockchain?
        i. Is blockchain central to their value proposition?
3. **Customers / Partners**
    a. Do you have any partners or customers?
        i. Who are your partners and what do they contribute with?
        ii. How important is blockchain for your partners?
        iii. What do your partners require from you?
        iv. How important is blockchain for your customers / end users?

**Closing questions**

1. **Post interview**
    a. We are going to transcribe this interview, do you want to read it before we use it?
    b. Is it fine if we use your name in our master's thesis?
    c. Do you know of any documents, articles or people we should get hold of that can contribute to our thesis?