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Developing a Blockchain-based Multi-sided Platform

A Case Study of a Digital Shareholder Register

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Problem Description

Multi-sided platforms (MSP) are technologies, products or services that create value primarily by enabling direct interactions between two or more customers or participant groups. This thesis investigates and describes the key challenges in developing such a platform, with a particular focus on platform architecture and stakeholder value creation. Furthermore, building on these findings, we devise and recommend strategic options for our case study, Startblock, a proposed multi-sided platform using blockchain technology to create a digital share register.

Preface

This paper was written as a master thesis at NTNU as part of the M.Sc. program Industrial Economics and Technology Management with program specialization in strategy and business development. The research and writing of the paper were conducted during the spring semester 2018.

The idea for this thesis came up during our work with our project thesis in the autumn of 2017 (Forselv et al., 2017), in an interview with Blockchangers AS, a blockchain consulting firm in Oslo. They argued that, despite a growing interest in research on blockchain technology, little or no research has been done on business model strategies for companies using this technology. This sparked our interest. In particular, we wanted to investigate the use of blockchain technology for platform businesses, and which value this creates for the stakeholders of the platform.

Readers of this report should preferably have some basic prior knowledge of what blockchain technology is, although we do explain the fundamentals in section 2.2. Some knowledge of platform economies or business models, either from research or real-world examples (companies such as Airbnb), would also make it easier to comprehend the realms of opportunities in the business models and multi-sided platform models this thesis discusses.

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> "A good business model begins with an insight into human motivations
> and ends in a rich stream of profits."
> – Magretta (2002)

Abstract

In the last few decades, the world has seen companies such as Amazon and Airbnb arise and grow record-fast, without even offering any new unique product or technology. These are examples of multi-sided platforms (MSPs), enabling direct interaction between different groups of customers.

A new technology with unexploited potential is the blockchain technology. Blockchain technology can allow decentralized systems to connect millions of users with each other in new ways, facilitating and recording transactions between two or multiple parties efficiently and in a verifiable and permanent way. More and more companies are combining blockchain technology with the platform model. This thesis researches how value can be created for stakeholders on multi-sided platforms that utilize blockchain technology.

We do this by creating a framework to analyze and design blockchain-based MSPs. The main goal of the framework is to maximize stakeholder value creation. We create this framework by combining existing frameworks on MSPs with stakeholder theory. The result is a framework that learns the requirements of a platform through a three-step stakeholder analysis. We demonstrate the framework by applying it on a case study of a proposed platform business, Startblock, a digital shareholder register, where we use both interviews and surveys to collect data from stakeholders.

The results show that the value creation from blockchain-based MSPs come mainly from those core services which utilizes the advantages of blockchain technology, such as digital signatures and transparency. These properties allow blockchain-based MSPs to offer:

- Secure trading of assets without intermediaries
- Cost-reduction by improving business processes
- The facilitation of compliance with regulatory requirements

From the application of the framework, we demonstrate how blockchain technology influences both the governance structure and the revenue model of MSPs. Next, we show that the way actors interact with each other heavily influences the blockchain architecture. Our research further shows the importance of stakeholder analysis in understanding the network effects on multi-sided platforms.

Finally, to overcome the well-known chicken-and-egg problem for platforms, we argue that new MSPs should start out by providing some core service to a single customer side with low switching costs. This way they can quickly attain a critical mass of at least one desired platform customer group, before they begin to introduce their more typical services with network effects.

Sammendrag

De siste tjue årene har verden sett selskaper som Amazon og Airbnb vokse rekordraskt uten å tilby noe unikt produkt eller teknologi. Disse er eksempler på flersidige plattformer (engelsk: multi-sided platforms), MSP-er, som muliggjør direkte interaksjon mellom ulike kundegrupper.

En ny teknologi med uutnyttet potensiale er blokkjedeteknologi (engelsk: blockchain technology). Denne teknologien kan tillate desentraliserte systemer å forbinde millioner av brukere med hverandre på nye måter, samt effektivt å legge til rette for og registrere transaksjoner mellom to eller flere parter på en verifiserbar og permanent måte. Flere og flere selskaper kombinerer blokkjedeteknologi med plattformmodellen. Denne masteroppgaven undersøker hvordan verdi kan skapes for ulike interessenter på en flersidig plattform som bruker blokkjedeteknologi.

Vi gjør dette ved å utvikle et rammeverk for å analysere og designe blokkjedebaserte MSP-er. Rammeverkets hovedmål er å maksimere verdiskapningen for plattformens interessenter. Vi utvikler dette rammeverket ved å kombinere eksisterende rammeverk for MSP-er med interessentteori. Resultatet er et rammeverk som kommer frem til alle interessentene på en plattform sine behov gjennom en trestegs interessentanalyse. Vi demonstrerer rammeverket på en casestudie av en foreslått plattform, Startblock, en blokkjedebasert digital aksjeeierbok, og bruker både intervjuer og en spørreundersøkelse til å samle data fra interessenter.

Resultatene viser at verdiskapning på blokkjedebaserte MSP-er hovedsakelig kommer fra kjernetjenester som utnytter fordelene blokkjedeteknologi tilbyr, som eksempelvis digitale signaturer og transparens. Disse egenskapene tillater blokkjedebaserte MSP-er å tilby:

- Sikker handel av aktiva uten mellommenn
- Kostnadsbesparelse gjennom å effektivisere forretningsprosesser
- Tilrettelegging for etterlevelse av regulatoriske krav

Fra anvendelsen av rammeverket demonstrerer vi hvordan blokkjedeteknologi påvirker både styringsstruktur og inntektsmodell for MSP-er. Videre viser vi at måten ulike aktører interagerer med hverandre på en plattform sterkt påvirker blokkjedearkitekturen. Forskningen vår viser viktigheten av interessentanalyser for å forstå nettverkseffektene på flersidige plattformer.

For å overvinne det kjente høna-eller-egget-problemet for plattformer, så argumenterer vi for at MSP-er burde starte med å tilby noen kjernetjenester med lave byttekostnader til en enkelt kundegruppe. På denne måten kan MSP-er raskt tiltrekke seg en kritisk masse av en kundegruppe før de deretter introduserer mer typiske tjenester med nettverkseffekter.

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List of Abbreviations

AML Anti-Money-Laundering

API Application Programming Interface

BFT Byzantine Fault Tolerance

BM Business Model

BMI Business Model Innovation

CSD Central Securities Depository

DLT Distributed Ledger Technology

MSP Multi-Sided Platform

MVP Minimum Viable Product

PoA Proof-of-Authority

PoC Proof of Concept

PoS Proof-of-Stake

PoW Proof-of-Work

UTXO Unspent Transaction Output

Chapter 1

Introduction

1.1 Background

A business model (BM) is a description of how a business can create, deliver and capture value for some customers, and who these customers are. In the last two decades, the BM has become an increasingly important unit of analysis in innovation studies, especially as more and more companies have successfully innovated their business model itself, not only their products and services (Massa and Tucci, 2013). In the lapse of a few decades, the world has seen companies such as Facebook, Amazon, and Airbnb arise to become huge international companies in record-time, without even offering any new unique product or technology. Several of them have the trait in common that they create value for their customers first and foremost as intermediaries. Such companies can be called platform businesses.

One type of platform business model is the multi-sided platform (MSP), a platform that creates value by enabling direct interaction between two or more distinct types of customers (Hagiu, 2014). The term multi-sided platform was first introduced and defined by Evans (2003), building on the theoretical research of two-sided platform markets of especially Rochet and Tirole (2003). However, Andrei Hagiu, a Visiting Associate Professor at the MIT Sloan School of Management and previously an Associate Professor at Harvard Business School, has in our opinion been the most active and visible writer of scientific articles on MSPs. He started writing about two-sided markets already in 2003 but used the MSP term for the first time only six years later in an article by Boudreau and Hagiu (2009). The article "Strategic Decisions for Multisided Platforms" by Hagiu (2014) gives a particularly good theoretical definition of the MSP model and its strategic implications, and our research in this thesis builds especially on this theory.

As actors on MSPs create value through interaction, they are dependent on each other. Current literature on MSPs describe which effects there are between the actors of a platform (Hagiu and Wright, 2015a; Smedlund, 2012), and some work has been done on frameworks that investigate

how the design of a platform has an impact on participants (Kazan and Damsgaard, 2016). In these analyses and frameworks, the focus is how platforms have an impact on the active user group of a platform. In this thesis, we expand the focus to include all stakeholders of a platform, not only its active users, and investigate which requirements they have to the platform design. Freeman (1984) describes that in order to create the most value, then all stakeholders' interests need to be taken into account when forming a company strategy. We therefore create a framework that combines existing MSP frameworks with theory on stakeholder value creation.

A new technology that has the potential to innovate and disrupt current business models is blockchain. After Bitcoin was introduced in a white paper under the pseudonym Satoshi Nakamoto in 2008, and was released the following year, the blockchain technology – the technology that Bitcoin is built upon – has gained increased publicity every year. Even more so than money and currencies, contracts and other types of transactions are critical for our society and economy. Herein lies the potential of blockchain, an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way (Iansiti and Lakhani, 2017).

1.2 Research Questions

In previous research, we have found that the majority of currently existing research on blockchain, as well as established initiatives using blockchain technology, are within banking and finance (Forselv et al., 2017). In this sector, the objective is that blockchain can be used to create a system with more decentralized trust, reduced transaction fees and significantly reduced processing times compared to existing systems. These three objectives, however, are not of interest only for the financial sector - they are also objectives for many others actors in the society. Additionally, in contradiction to the financial industry, where our previous research indicated that the blockchain-caused innovation will mostly be incremental and happen back-office at the established incumbent firms, there is a possibility that other parts of society will experience a more distributed value-creation. We have not seen this question discussed in existing literature.

In areas where the blockchain technology will allow MSP models to operate successfully, there is also a possibility that entirely new customer groups can become involved. One example of such would be if small-scale investors could get a chance to invest broadly in startup companies, not only in listed companies and in bonds. This would perhaps simultaneously fill the funding gaps that many startups have. Such opportunities of stakeholder value creation for blockchain-based MSPs is another gap in existing research. Our objective with this thesis has therefore been to investigate this topic, as well as the gaps described above. We have researched how MSPs can be used for blockchain technology and also how stakeholder value creation in such settings occur.

All the above lead us to define two central research questions for this thesis. The first one is framed in a conceptual manner while the second is aimed at empirical studies:

- **RQ1:** How can a framework for analyzing MSPs be adapted to fit blockchain-based products and services?
- **RQ2:** How can a blockchain-based platform create value for different stakeholders?

There is disagreement in the literature on how to define value and value creation. Freeman (1984) does not define the term value but argues that all stakeholders need to benefit over time. Stakeholder theory seems to be split in two groups: Those who focus on value as economic value, and those who measure it through several utilities. Agle et al. (1999) are part of the former group, whereas Bosse et al. (2009) is somewhat in between: they believe that although economic value is important for the main stakeholders, value can be more intangible for other stakeholders.

Harrison and Wicks (2013) show that most academic studies measure value as economic performance, and they therefore argue that other utilities than economic performance are neglected. In their paper, they propose the following definition of value: "anything that has the potential to be of worth to stakeholders". In this way, Harrison and Wicks put more focus on the utility stakeholders receive beside just economic value. We follow their definition in our research, and we do this through a pragmatic approach where we define value for each individual stakeholder in the stakeholder analysis.

1.3 Contribution

Our research contributes to multi-sided platform research, a part of business model research. Current frameworks for MSPs have taken technology into consideration, but we further develop them by considering blockchain technology specifically. We both adapt previous frameworks and add new components. Also, we include stakeholder theory in our framework, based on the stakeholder theory of Freeman et al. (2004). By extending Freeman's research into a new domain, that of blockchain-based MSPs, we contribute to stakeholder theory.

In our research, we further demonstrate how our framework can be applied on an MSP business idea to make architectural choices. This practical example strengthens the application value of our research for business managers. Furthermore, this has given us insights into the needs for further research on the topic, something we contribute back to academia and encourage other researchers to follow up on.

1.4 Approach

Our approach in this thesis is to first provide a context for our research questions within business strategy theory, and to gradually dig down into the specific theory we will use. As illustrated in figure 1.1 below, we begin by looking at Business Model Innovation (BMI) and argue that Multi-sided Platforms (MSP) is one part of this strategy area. We then introduce stakeholder theory and combine it with that of MSP strategy, as well as with blockchain technology, to develop our framework. The framework is developed to be a tool for analyzing and designing blockchain-based MSPs, and to be of help for investigating how such MSPs can create value for different stakeholders (RQ2).

We have used a research method called *systematic combining*, characterized by continuous movement between an empirical world and a model world (Dubois and Gadde, 2017). This method is further described in our chapter on methodology, see section 4.1.1. Figure 4.1.1 illustrates it simply. We used *theory* from literature and previous research to create a *framework*, a framework that later functioned as a guideline for us in our *empirical* research. To test how our theory research matches reality, we used a *case* study company on which we apply our framework. Our aim with this process was to find valuable and generalized insights along the way.

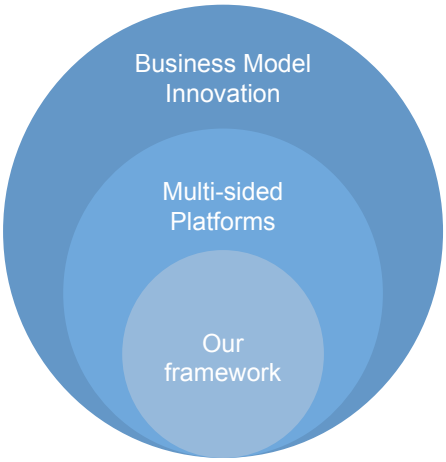


Figure 1.1: Strategy Research Approach

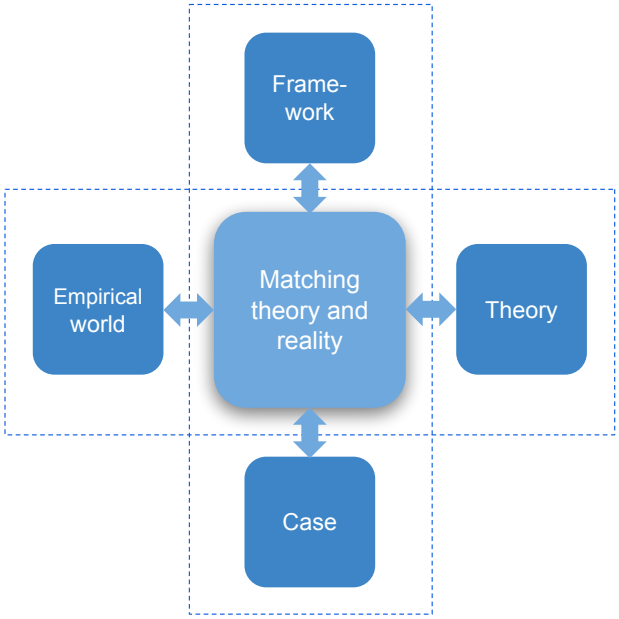


Figure 1.2: Systematic combining

The case study for our thesis was a blockchain-based company under development of *Blockchangers AS* and *DNB*, a blockchain consulting firm in Oslo and the largest bank in Norway, respectively. Their business idea, a company called *Startblock*, was to create a platform for a digital shareholder register and a marketplace for shares built on blockchain technology. This was an

interesting example of how blockchain technology can be applied to an industry populated by a few large actors and under much regulation. Also, it was one of very few examples of blockchain-based MSP initiatives that we knew of.

We have done empirical research through interviews and surveys of relevant stakeholders, in addition to gathering existing data about among other policy and legislation that affected our research. Our objective with using systematic combining was to combine what we found to be an exciting theoretical problem with an interesting real-world case. Exploring existing literature and theory is an essential part of systematic combining, and has also been important in our research. But as Dubois and Gadde (2017) emphasize: theory should not constrain researchers, but rather help discover concepts and phenomena.

1.5 Outline

This thesis is divided into three parts: part I with background information, part II with application of a framework developed in part I to analyze our case study, and part III that contains a discussion of and conclusions to our research more broadly, not only to our case study.

In the next chapter, we provide some background information for the reader to properly understand the content and context of this thesis. We introduce the case study company, blockchain technology and some topics relevant to our case study, among them the shareholder register and crowdfunding. Readers familiar with these areas can safely skip these sections, but our purpose has been to give a brief introduction to those who are not and to make clear any definitions and terms we use.

In chapter 3 we introduce the theory that provides the foundation for our research. This includes strategy research on business models, business model innovation and multi-sided platforms. We also develop and present our framework for analyzing blockchain based MSPs based on existing frameworks and the theory introduced earlier in this chapter, as well as through insights from empirical research. All parts of our framework are thoroughly explained here, and this chapter does therefore to a large degree answer RQ1, although the framework is also further discussed in chapter 9.

In chapter 4, we present our choice of methodology and research design. In developing our framework we use a method called systematic combining, which we explain here. We also describe how we decided on literature, and how we went forward to gather data through surveys and expert interviews, and how we have worked to analyze our case study. The validity and reliability of our findings are also discussed here.

In part II, chapter 5-8, we apply our framework to our case study, Startblock. We present the stakeholder ecosystem of the platform, and our data collection. Then, in chapter 6 and 7 which represent the second tier of our framework, we discuss the implications of our findings on the platform architecture of Startblock, and on their blockchain architecture. Here our purpose is to learn how to design an MSP model in such a way that it will give the greatest total value to all stakeholders, using our case study as an example. In the last chapter of this part, chapter 8, we summarize which implications the previous chapters have for the solution architecture of Startblock, and exemplify these implications through some specific proposals to our case study.

In part III, we generalize the insights from part II and our case study. Chapter 9 discusses our findings and their implications, as well as some limitations of our research. In chapter 10 we summarize our research in terms of generalizable insights and how we have answered our research questions, and present some recommendations for further work and research on this subject.

Finally, in the appendix, we provide a timeline of our research, a list of all interviews we have performed and our interview subjects, our interview guides and survey questions.

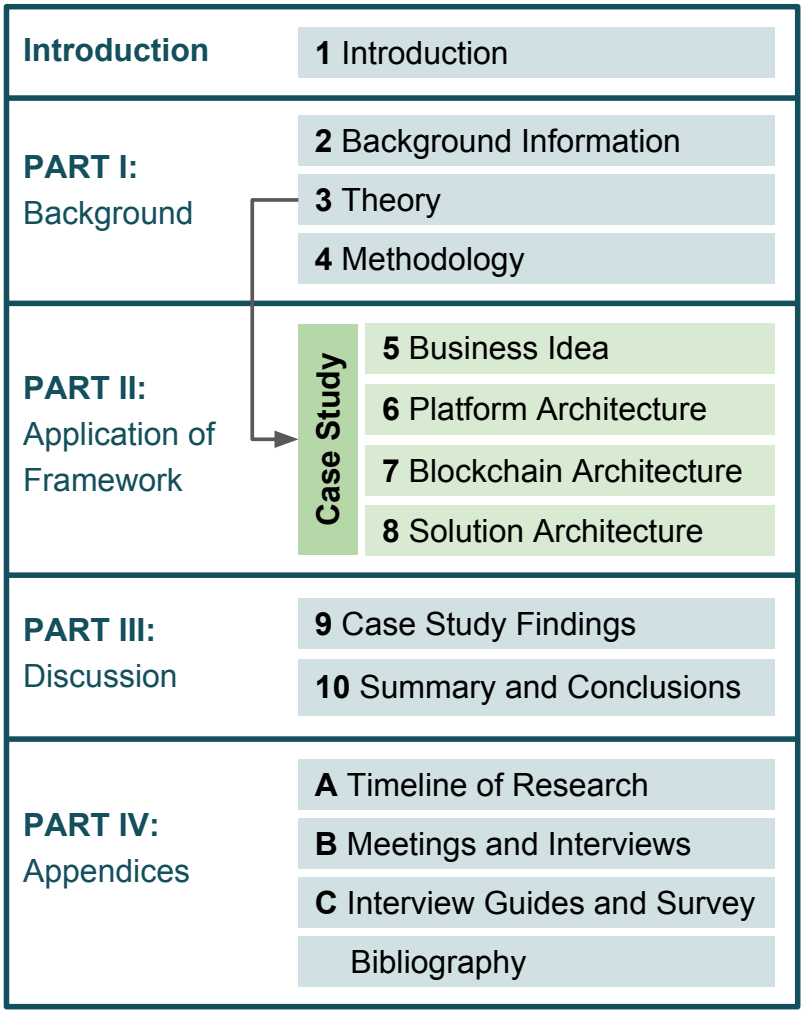


Figure 1.3: Outline of this thesis

Part I

Background

Chapter 2

Background Information

This chapter first and foremost introduces our case study company, but also gives some background knowledge about other topics that will help the reader fully understand the content of later chapters in this thesis. For readers already familiar with the case study or the area our case study operates in, one might skip one or several sections.

2.1 Case study: the Startblock Platform

The case revolves around a proposed platform business called Startblock. Startblock is an idea developed by Blockchangers AS, a blockchain consulting firm in Oslo. In the following sections we introduce them, their proposed value proposition, products and services, potential market size and competitors. Our focus is on giving enough knowledge to grasp the content of this thesis.

Figure 2.1: Startblock Logo

Blockchangers AS is, according to themselves, Norway's leading blockchain company, helping others both understand and utilize the blockchain technology (Blockchangers). The company was founded by their current CEO, Jon Ramvi, in 2015, and currently has six full-time employees. They provide or have provided services for several large Norwegian companies and institutions such as DNB, the Tax Authorities, Aftenposten, Statkraft and Storebrand.

2.1.1 Business Idea and Cooperation with DNB

Blockchangers believe that blockchain technology can and soon will be used for much more than cryptocurrencies, the side of the technology that currently gets more attention. Also, they believe that other uses will have much greater benefits for the society. One area where they believe the blockchain technology could be used, and which gave them the idea to our case study: Startblock AS, is to tackle the increase they expect in the number of people investing in startups in Norway, with all the paperwork and overhead such investments bring with them. They expect such an increase because of, among other things, the new tax incentive scheme Norway adopted in 2017 (see section 2.4).

All Norwegian private limited companies must have a share register (Lovdata, a), and they must every year submit this to the Norwegian Tax Administration's Shareholder Register. As we can quote from Altinn (2017):

> "This register [of shareholders] must contain an overview of the names of the company's shareholders at all times, and it will normally be decisive as regards who can exercise shareholder rights. The share register must be stored and kept in a secure manner. It is normally kept in electronic form. The share register is a public document, so the general public have the right to see it."

Startblock is planned to become a digital platform that, among other things, offers a digital shareholder register that automates the reporting to authorities and updating of the register (see more about this and other proposed uses in the next section about value Startblock's proposition). Furthermore, Startblock is not only a project by Blockchangers - they have also managed to get DNB, the largest bank in Norway, to show interest in this business idea and are currently in a dialogue with them about an investment in Startblock.

The vision of Startblock and DNB is that Startblock will be an independent company, but partly owned or connected with DNB. The bank has two main motivations to join the project: First, they always want to offer better services to their clients. They have both investors and startups as customers, and they observe that there are several administrative nuisances for startups,

among other concerning the capitalization table. Solving some of these problems may attract startups to DNB. The purpose would then not be to create revenue, but to attract new clients and make existing clients even more satisfied.

The second motivation for DNB to get involved with the Startblock platform is the opportunities for added revenues. Startblock might create revenue for DNB if they, for instance, start to offer financial services on the platform, such as payment services (escrow services), cash/credit to shareholders and private limited companies, loan financing and more. Judging on our interview with DNB, it is clear that the first motivation is the strongest of these (Skjærholt, 2018). Startblock would not be locked to use only DNB, but DNB could get a right of first refusal on any offer other banks make to Startblock.

2.1.2 Startblock's Value Proposition

Norwegian private limited companies must store their shareholder data for minimum 10 years, and for every shareholder they should submit to Norwegian tax authorities the number of stocks the shareholder owns, the stock number of these and – if applicable – the stock class (Skatteetaten, 2015). Today, most of the process related to reporting of and updating the shareholder register is conducted manually, and for startups with a high number of shareholders this is time-consuming work. This manual work also increases the likelihood of mistakes, and realistically a lot of companies do not report all their transactions. This leads to reduced transparency and control for Norwegian authorities.

Startblock Cap Table

By creating a free application that helps companies update their shareholder registers and automatically report them to Altinn, Startblock hopes to allure a large part of Norwegian startups to use the platform. This application will also give Norwegian authorities real-time updates about changes in the share registers of companies, instead of only once a year, and thus an incentive for them to cooperate. Also, perhaps most importantly, it will remove the overhead burden of having many shareholders for companies. As Norway has just introduced a tax incentive scheme for people that invest in startups (see section 2.4), with the number of available investors expected to increase, the timing for this is perfect.

A solution for digital cap-tables would not be unique, and there are already several existing solutions. Among those who offer such in Norway are Visma and the Norwegian central securities depository Verdipapirsentralen (VPS), but first and foremost Silicon Valley startups such as Gust Equity, capshare.com and captable.io. The entrepreneurs of Startblock, moreover, think that the Norwegian and European alternatives are not nearly as good as the American ones (Blockchang-

ers, 2018). However, with inspiration from the international best practice, Startblock hopes to quickly be able to develop a good functionality and user experience design.

Startblock Marketplace

The novel part of the Startblock Cap Table would be its adaption to Norway and the EU, and that it is built on blockchain. This technology allows for extra services on top of the platform, for instance an application for trading shares in these unlisted stock companies: a marketplace. For several startups it is hard to find and get in touch with potential investors, and for many investors – especially hobby or small-scale investors – it is hard to find interesting startups to invest in. Startblock could become a platform where startups and investors can meet and get matched, with instant settlement and real-time updates of the shareholder register. This makes it easier for investors to trade already owned shares, and for startups to conduct new emissions.

The Startblock Marketplace solution would be achieved through representing securities as tokens on a blockchain. Through smart contracts on the blockchain the platform could allow so-called peer-to-peer (P2P) trading. The challenge lies in how to write a protocol such that the tokens will comply with laws and regulations for securities, initially for unlisted stocks in Norwegian private limited companies. As we will see in section 2.6, the requirements might differ from company to company. Furthermore, the fundamental platform solution should be able to support different securities in the EU for the platform to be able to scale.

Startblock Portfolio

With a real-time updated shareholder register, the other participant group of the platform, the investors, can also automatically get an overview of their investment portfolio. As with the cap table, this product would not be unique nor something that provides revenues for Startblock, but it would be another argument for investors to use the platform. Today most investors keep track of their portfolio manually, typically in a spreadsheet they create themselves (Blockchangers, 2018).

Other Ideas

Startblock-as-a-Service is an idea to make the Startblock platform available for third parties through application programming interfaces (APIs). This would allow other companies to utilize the platform and create added value for the platform participants through new products. Startblock could then obtain new revenues from a transaction fee on all activities on the platform.

Equity crowdfunding can currently be done through several platforms in Norway (see section 2.5), but the leading solutions only coordinate the crowdfunding online, they do not automate

the processes. The Startblock platform could automate the Know Your Customer (KYC) process, matching of investors and crowdfunding campaigns, payments, escrow, creating cap tables and reporting to authorities.

As it becomes more common to invest in many unlisted companies, and in companies one does not otherwise have any relation to, it becomes hard to follow up on and participate in the companies' general assemblies. However, as an investor, one might have an interest in doing so. Today, there exist some expensive solutions for scanning share certificates and ballots to conduct general assemblies remotely in a correct way (Blockchangers, 2018). Startblock would easily be able to facilitate this, using the data it has about the distribution of shares and shareholders. It might indeed be possible to conduct the whole assembly virtually, something that would save time and costs for all parties.

2.1.3 Market Size

More than 99% of all registered enterprises in Norway and the European Union are defined as small and medium-sized enterprises (SMEs) according to the definition used by the EU (European Commission; Statistisk Sentralbyrå, 2018). SMEs must according to this definition, among other things, have less than 250 employees. In Norway, on the 1st of January this year, there were 577 067 registered enterprises, of which 200 016 had employees (Statistisk Sentralbyrå, 2018). The details can be seen in table 2.1.

If Startblock were to target enterprises with 1-49 employees, that would amount to 190 404 enterprises or 95% of all of them that have employees. As different statistics often use different definitions of enterprises, it is hard to find the exact numbers, but the majority of these enterprises can be assumed to be private limited companies, the entities that Startblock would be of interest to.

However, the majority of private limited companies have only one or a few shareholders. Statistics Norway stopped tracking this specific statistic after 2013, but at that time 79% of all private limited companies in Norway had 1-2 shareholders, 93% had 1-4 shareholders and 97.6% had 1-9 shareholders (Statistisk Sentralbyrå, 2014). On the one hand, it seems reasonable that only companies with many shareholders would mind adopting a new platform to keep track of, manage and communicate with their shareholders. That is, only a small minority of all companies. On the other hand, one might argue that the real opportunities lie in the companies that today do not have many shareholders due to the hassle that having many shareholders bring along. If this is the more likely case, then Startblock should suddenly target a much larger part of the market.

Which of the marketing strategies described above that Startblock should aim for is not evident, but we hope to give more insights into this strategic decision in later chapters in our thesis.

Table 2.1: Enterprises in Norway according to number of employees, 01.01.2018 (Statistisk Sentralbyrå, 2018)

Employees	Enterprises	Percentage
0	377 051	65.3%
1 - 4	98 331	17.0%
5 - 9	41 757	7.2%
10 - 19	29 662	5.1%
20 - 49	20 654	3.6%
50 - 99	6 133	1.1%
100 - 249	2 715	0.5%
>250	764	0.1%
Total	577 067	100.0%

Table 2.2: Private limited companies in Norway according to number of shareholders in 2013. Unfortunately, newer statistics are not available (Statistisk Sentralbyrå, 2014)

Shareholders	Companies	Percentage
1	132 634	58.3 %
2	47 542	20.9 %
3 - 4	31 519	13.8 %
5 - 9	10 716	4.7 %
10 - 19	2 560	1.1 %
20 - 49	1 454	0.6 %
50 - 99	621	0.3 %
>100	552	0.2 %
Total	227 598	100.0 %

2.1.4 Competitors

Norwegian companies that register the company's shares with the Central Securities Depository (CSD) in Norway (Verdipapirsentralen), are exempt from keeping their own shareholder register. The costs affiliated with using the CSD depend on a company's corporate actions, share capital and shareholder count. The CSD is although primarily targeted towards large companies with many shareholders and companies listed on the stock exchange, and will for the typical small company be a too extensive and costly solution. A more thorough description of the CSD can

be found in section 5.2.6.

The leading Nordic software company Visma offers a solution called Total Aksjebok that consists of a simple electronic shareholder register with automatic reporting to the authorities, and does so not bring much more functionality beyond keeping a traditional spreadsheet. The annual subscription fee for Total Aksjebok is NOK 4600 (Visma, 2018).

What's more comparable to Startblock's plans are some novel solutions brought to life recently. Bizbot is a new company that aims to offer automation of tasks such as keeping a shareholder register, managing of emissions and fundraising. As of now, only the shareholder register product is launched in the market. Owner's room is another new company offering a shareholder register with equity management, as well as offering an investor relations solution and a capital market with trading of shares.

Within crowdfunding there are a few solutions operational in the Norwegian market today. For equity crowdfunding we have the small Norwegian platforms Folkeinvest and Dealflow. SparkUp is a French platform running a Norwegian subsidiary. FundedByMe, a larger Swedish platform, as well as Invesdor, a large Finnish platform, are also operating in the Norwegian market. Lastly, Monner is a Norwegian company doing loan-based crowdfunding. What characterizes these platforms is that they only provide a way to market and organize a crowdfunding campaign, but end the relationship to the companies after the campaigns have ended.

CrowdWorks is also a company worth mentioning. It is a Norwegian company offering solutions aimed at engaging company shareholders, administration of new funding rounds, and more efficient investor relations.

2.1.5 Timeline of Project

Blockchangers created their first Proof of Concept (PoC) of the Startblock platform with the cap table service in 2016, and did some further experimentation with other possible platform services early in 2017. Now they have formalized their cooperation with DNB and plan to restart the project together in Q2 (the second quarter of) 2018, developing some Minimum Viable Products (MVPs) late in 2018 (Blockchangers, 2018).

In Q1 2019 Blockchangers plan to release version 1.0 of the Startblock platform, together with a PoC of the Startblock Marketplace. Version 2.0 is supposed to be released in Q3 2019 before Startblock should start marketing and doing sales in Q4, and thus also to generate its first revenues for them and (eventually) their investors. If this all this succeeds, they would like to enter

the European market through an entry to Northern-Europe first.

This spring, in 2018, Blockchangers have allowed us to use the Startblock platform as a case study for our research and master thesis. Although we have no task nor research questions assigned by them, they hope to gain some valuable insights and feedback on the business idea through our work.

2.2 Blockchain

After Bitcoin was introduced in a white paper by Satoshi Nakamoto in 2008 and was released the following year, the blockchain technology has gained increased publicity every year. Furthermore, since around 2014, a wide range of startups and established actors have started to believe in and experiment with blockchain technology as well.

To understand what blockchain is, one first needs to know what a *distributed ledger technology* (DLT) is. According to the definition used by UK Government Office for Science (2016), a DLT is a replicated, shared and synchronized database that is spread across multiple sites, in which records are stored one after another in a continuous ledger. A blockchain is a type of DLT where new transactions are put together in blocks and linked to the last block of the blockchain using cryptographic signatures.

Figure 2.2 introduces a simple framework inspired by Hileman and Rauchs (2017) that can be used to easily distinguish between traditional distributed databases, distributed ledgers and blockchains. The concept of permissioned blockchains is introduced in section 3.4.5.
With blockchains, transactions are sent to each node in a decentralized peer-to-peer network. This means that all the actors have an identical version of the ledger, which gives three important properties:

- *Immutability* means that it is not possible to change a transaction once it has happened. Each participant on a ledger can be certain that the information stored on the ledger is accurate, and that all parties agree on this state. This has several benefits, e.g. that one is not reliant on a third party to verify the transactions. The agreement about a state is achieved through consensus protocols.
- *Redundancy* means that as the data is stored in several locations, the network is still operational even if several nodes are unavailable. This makes distributed ledgers more resilient and secure.

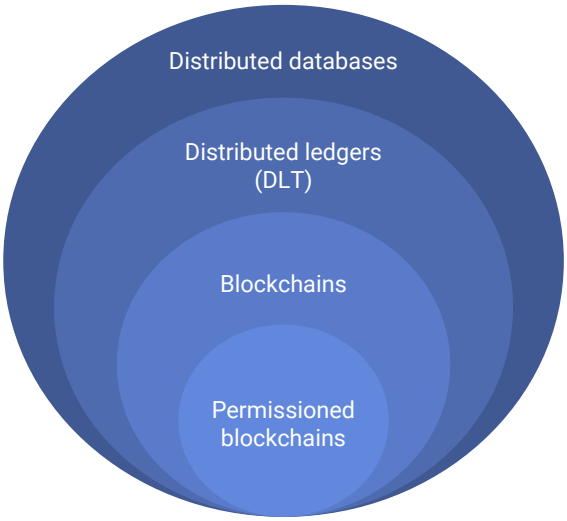


Figure 2.2: Framework for understanding the connection between DLT and blockchain. Inspired by Hileman and Rauchs (2017). Illustration from Forselv et al. (2017)

- *Transparency*, as the decentralization implies that all transactions can be visible to all participants of the ledger. It is, however, possible to give parties viewing rights only to the areas they need. This provides both the necessary privacy and transparency in combination.

In section 3.4.5 we go through and explain all of the blockchain features that are essential for this thesis, among them different permission models, the most used verification and consensus algorithms, transaction models and what smart contracts are.

2.3 Plans to Renew the Shareholder Register

In early 2014, the Norwegian Parliament proposed for the Government to create a public electronic shareholder register, to be established in 2015, with a goal to secure more transparency and openness about who owns shares in which companies in Norway. According to the Norwegian Ministry of Trade, Industry and Fisheries, the shareholder register is an important source for such information, but currently not accessible enough, as one has to contact any stock company directly to get access (The Norwegian Ministry of Trade, Industry and Fisheries, 2014). Furthermore, openness around such information contributes to important economic and democratic discussions.

As a result of the decision mentioned above, stated in a Proposition to Parliament ("Prop. 94 LS (2013-2014)"), *the Brønnøysund Register Centre*, a government agency that is responsible for the

management of numerous public information registers for Norway, wrote and published a report called "An electronic shareholder register in Altinn" (Brønnøysund Register Centre, 2014). Altinn is the main internet portal used for handing in electronic documentation to the Norwegian authorities. Now, more than three years after it was published, and despite the decision to establish the register in 2015, still nothing seems to have happened.

According to a report by Deloitte (2018, p. 48), however, the Brønnøysund Register Centre cooperates with IBM and OsloMet, the Oslo Metropolitan University, on exploring the opportunities for a shareholder register on blockchain. They also write that in 2017 the state Delaware in the US was the first to adopt legislation that allows the use of a blockchain-based system for a company register, including maintenance of shareholder registers. Moreover, supposedly both Holland and Canada has shown interest in such a company register for new companies. IBM is also working in Italy, according to a Reuters article by Irrera and Kelly (2017), where they build a blockchain-based platform to issue private shares of SMEs digitally. Their goal is to give these companies better access to credit and investors through making it easier and more secure to exchange shareholder information of unlisted businesses. The project uses the open-source blockchain Hyperledger Fabric.

2.3.1 The Issue of Transparency

It is stated in clear terms in the report of the Brønnøysund Register Centre that the electronic shareholder register should include an opportunity for the public to look up the shareholder list of any single company. However, they propose that it should not be possible to look up people by names and to see all his/her stocks (Riesto, 2015). Their reasoning for this, is that although such a function would give better insights into the ownership and power structures in the society, it would be negative for people's privacy, and it is also not part of the shareholder register's purpose as it is stated in the law.

A solution proposed by the Brønnøysund Register Centre (2014) that could give more transparency but simultaneously protect people's privacy, is that the media alone could get online regulated access to the electronic shareholder register. This would allow journalists to find the information and generate the content they desire in a similar way to how they today also are given access to Norwegian tax lists.

> "Today this [shareholder register] is updated once a year, and that is not transparent. An electronic shareholder register would be a quantum leap forward both what regards simplification and control. It gives real-time information and will be very important both for the authorities and those who will use the register."
>
> – Geir Arne Glad, Director of communications, The Brønnøysund Register Centre (Riesto,

2015)

2.4 The Tax Incentive Scheme

On the 1st of July 2017 the Norwegian Government introduced a tax cut for investing in startups called the *tax incentive scheme* ("Skatteinsentivordningen") (The Norwegian Tax Administration, 2017). Investors may receive a tax cut for an amount up to NOK 500,000 invested as share contributions in startup companies (minimum NOK 30,000 per company). With the Norwegian income tax of 23% for general income, this means that an investor's tax burden could be reduced by up to NOK 120,000.

There are several requirements for obtaining this tax deduction, among other that the investor is not previously affiliated with the startup in any way, that the shares are owned for minimum three calendar years after the end of the year in which the investment was done, and that the startup cannot pay dividends in this period (The Norwegian Tax Administration, 2017). Furthermore, the startups must be less than six years old, have fewer than 25 FTE (full-time equivalent) employees and less than NOK 40 million in operating revenues. Also, any company can receive a maximum of NOK 1.5 million in contributions which give entitlement to the deduction annually.

Despite the requirements, the Ministry of Finance expects the tax incentive scheme to increase the amount of available private capital to be invested in startups over the coming years (Finansdepartementet, 2017). They estimate that about 40% of Norwegian private limited companies fulfill the requirements to size and age, and that the incentive scheme would lead to tax cuts of roughly 330 MNOK already in 2017.

2.5 Crowdfunding

Crowdfunding is a form of financing that connects people who can give, lend or invest money with those who need financing, often SMEs at an early stage of company growth, typically relying on small investments (Comission, 2018). It usually happens through a digital platform on which the platform provider interacts with its clients, both the investors and SMEs, digitally without taking on own risk. An investment in a crowdfunding usually leads to either an equity stake in a company, a loan agreement (sometimes called crowdlending) or ownership of a product that the company will deliver (reward-based crowdfunding). For this thesis, and for our case study, equity and loan-based crowdfunding is the most relevant types.

In addition to being an alternative source of financing, crowdfunding can also provide benefits such as concept and idea validation to the project owner, access to a large number of people interested in in the company, idea or product, as not to mention marketing effects if the crowdfunding turns out successful. As mentioned in section 2.1.4 there are several equity and loan-based crowdfunding initiatives present in Norway today. However, the Norwegian market for alternative financing is small, both in absolute terms and compared to other European countries.

According to a European study of Ziegler et al. (2018), the market volume for all alternative financing done through specialized platforms, including all types of crowdfunding and peer-to-peer lending, was €5 million in Norway in 2016 (up from €1.3 million in 2015). As a comparison, the other Nordic countries Sweden, Denmark and Finland in 2016 had a market volume of €86, €88 and €142 million respectively. As mentioned, this does not include independently run campaigns, and thus not the one of the Norwegian company reMarkable in 2016, which broke all previous Norwegian records by reaching €14.5m in pre-sales of their proprietary e-paper tablet . The total European market was €7671 million in 2016 (up 41% from 2015), of which – however – only €2063 million was outside the market leader UK. Figure 2.3 shows how Norway scores compared to other European countries on a per capita basis.

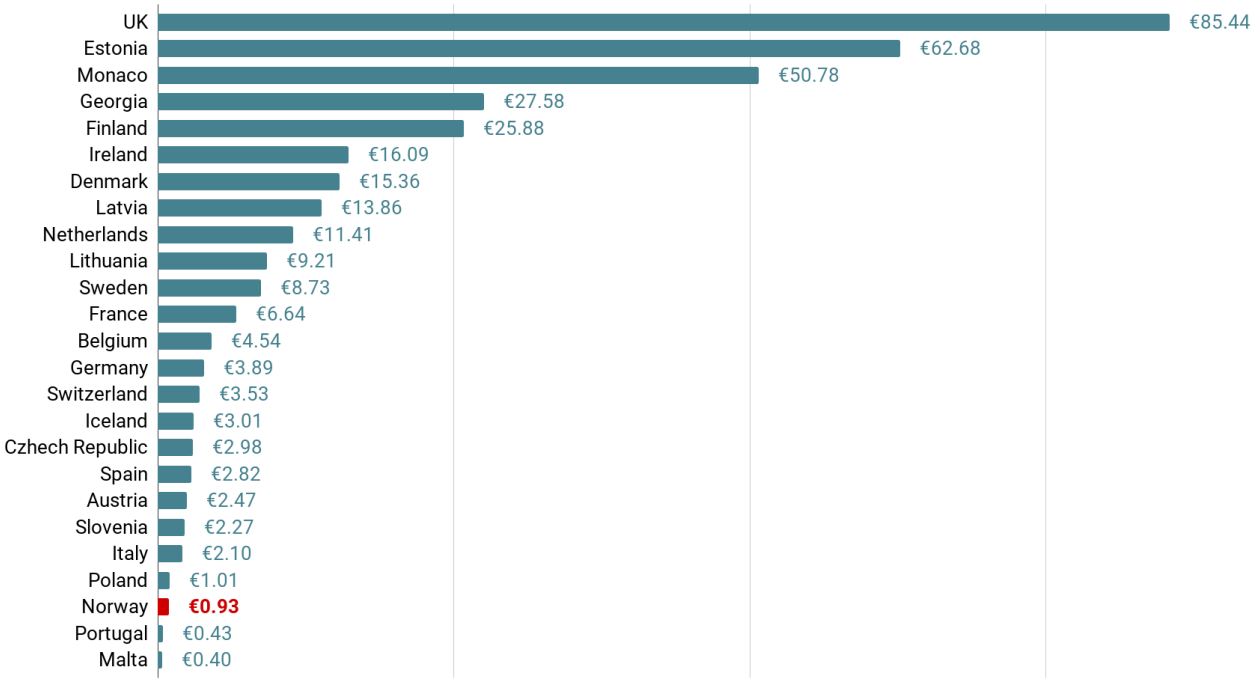


Figure 2.3: Market volume per capita by country for Europe 2016 (Ziegler et al., 2018)

Rotem Shneor, an associate professor at the University of Agder (UiA) in Norway, and also co-writer of the report with Ziegler, believes Norway might catch up with the other Nordic countries

on market volume if the Norwegian regulation becomes better and more clear. In December 2017 he said that he finds the Norwegian regulation hard to interpret (Beta, 2017). Just since then, however, quite a lot has changed. In early January 2018, Monner was the first Norwegian crowdfunding platform to get a licence from the Financial Supervisory Authority of Norway (Finanstilsynet) (Shifter, 2018). Also in policy there is currently a wind of change.

2.5.1 Regulation of Crowdfunding

The current government of Norway stated in their political platform, the Jeløya platform of January 2018, that they want to "make it easier to use crowdfunding in Norway" (The Norwegian Government, 2018). In March 2018, the Minister of Finance re-confirmed this in a hearing about crowdfunding in the Norwegian Parliament, but did not want to specify if she considered it necessary for Norway to adjust domestic regulation, of if the new EU regulation is sufficient (Stortinget, 2018).

In March 2018 the European Commission presented a proposal for a regulation on crowdfunding service providers (Comission, 2018). The proposal only applies to crowdfunding providers that are meant to give a financial return for investors, such as investment and lending based crowdfunding. Thus, initiatives such as Kickstarter where only products are sold, will not be affected. The new rules will give investors on crowdfunding platforms a better protection regime and a higher level of guarantees, based on, among other things, clear rules on information disclosures for project owners and crowdfunding platforms.

2.6 Legislation

In the Norwegian Public Limited Liability Companies Act, there are several regulations on trading of shares. However, the statues as decided by the general assembly of any company might override most of these. For instance, according to §4-15 (2), the board of a company has to approve of all sales (Lovdata, a). Also, according to §4-19, existing shareholders in a company have a right of first refusal when a share is traded. If not overridden by the statues, the shareholders have two months from the time the company is informed about a trade to decide if they want to use their right of refusal, according to §4-23 (1).

Both the requirements mentioned above slow down trading of shares significantly and require a centralized control and regulation, which many shareholders consider positive. If desired, however, they could both be overridden by the company statues. Shareholder agreements might regulate trading of shares beyond what the Companies Act and a company's statues regulate. For instance, they might include regulation of how early it should be possible to sell one's shares.

Apart from the regulation of trading of unlisted stocks, the law also regulates which companies can provide banking and payment services. Crowdfunding is regulated as a financial activity, and as such regulated by the Financial Supervisory Authority of Norway. They require companies to obtain special licenses for their business. With Startblock's current business model, it would need a license for payment institutions. The processing time for such a license is usually three months and requires a fee of 30,000 NOK to be paid in advance (Finanstilsynet, 2017). Monner, which has been mentioned before and offers crowdfunding of loans, came under this requirement and got their license in January 2018 (Monner).

The license for payment institutions requires a starting capital of €20 000, €50 000 or €125 000 depending on which payment services it would offer, according to the Norwegian Financial Undertakings Act §3-4 (Lovdata, c). If Startblock were to conduct payment transactions as agreed upon on their platform, described in the Financial Agreements Act §11 first paragraph letter b), they would need the starting capital of €125 000 (Lovdata, b). Monner is similarly regulated. There are also requirements to the board and the CEO of the companies which apply for such licenses, what regards their fit for the position.

Chapter 3

Theory

This chapter introduces central theoretical concepts and perspectives from the two main areas of research investigated in our thesis: business model innovation (focused on MSPs) and blockchain technology. This theory is used as a foundation for our research and to develop an analytic framework, which we develop and present at the end of this chapter. The framework is then applied to our case study in part II of our thesis.

3.1 Business Model Strategy

A business model (BM) was in chapter 1 introduced as a description of how a business can create, deliver and capture value through business with customers, and who these customers are. Magretta (2002) defines BMs as "stories that explain how enterprises work". Additionally, according to Massa and Tucci (2013), BMs should also describe the economic logic that enables a firm to do this at an appropriate cost and making a profit in the process.

> "A good business model begins with an insight into human motivations
> and ends in a rich stream of profits."
>
> – Magretta (2002)

Massa and Tucci (2013) write that firms always have operated according to a BM, and that until the mid-1990s firms traditionally followed a similar logic. In this business model logic, an industrial firm, with the help of its suppliers, delivered a product or service to a customer from which it collected revenues. In the course of the last two decades, however, firms have emerged that employ novel logic, and several scholars agree that this trend has been catalyzed by the emergence of the Internet and other information and communication technologies (Massa and Tucci, 2013). This has increasingly popularized research into BMs.

A BM might understandably seem to be something similar to the *strategy* of a firm. Casadesus-Masanell and Ricart (2010) argue that a BM is a reflection of a firm's realized strategy, but not itself a strategy. A BM refers more to the logic of the firm, the way it operates and how it creates value for its stakeholders, whereas a strategy regards the choice of BM through which it will face its competition. Dealing with competition is the strategy's job, according to Magretta (2002), including how to be different from rivals and how to do better than them.

When BMs fail, Magretta (2002) believes it is because they fail one of two critical tests: the narrative test or the numbers test. The *narrative test* is when a story does not make sense and a firm tries to achieve something that is not realistic, e.g. that suppliers with high bargaining power should accept worse terms. The *numbers test* is about profit and loss (P&L), about doing some spreadsheet math to test e.g. whether or not industry margins are high enough to provide all desired service, to cover costs and to generate a profit. The focus of this thesis has been on what regards the narrative test.

3.1.1 Business Model Innovation (BMI)

As research into BMs has become more popular, it has gradually intersected with the domain of innovation. This has advanced to two complementary perspectives on BM and innovation (Massa and Tucci, 2013): First, good and suitable BMs enable innovative firms to commercialize new ideas and technologies. Second, a BM can also be viewed as something to be innovated itself, and to potentially itself become a source of competitive advantage. The latter is what has become known as business model innovation (BMI), and what has fostered among other the idea of MSPs, which we study in detail in the next section. Let us first, however, explain the difference between the two complementary perspectives on BMs and innovation.

The first perspective is that BMs must be designed appropriately to unlock and realize the value potential of new innovations, be it new technology or services. Massa and Tucci (2013) write that the BM must become a vehicle *for* innovation, as the innovation itself, e.g. a novel technology, does not have any inherent economic value per se. An example of this is the first photocopy machine invented by Xerox, which was too expensive to be sold. Xerox then solved the problem by leasing the machine, adapting their BM to the innovation; the BM became the vehicle for innovation.

From the second perspective, the BM is not just a vehicle that enables innovation, but it represents an innovation itself. BMI can be especially valuable in situations of intense competition and mature industries, as a novel BM might be a source of disruption, changing the economic logic of an industry (Lindgardt et al., 2009). According to Amit and Zott (2012), it might be harder

for competitors to imitate an entire novel BM than just a single novel product or service. And in an analysis of innovative firms in 2009, the Boston Consulting Group found that BMIs earned an average premium over the average total shareholder return for their industries four times greater than that of process innovators. Moreover, the BMIs delivered returns that were more sustainable, continuing to outperform their competitors even after ten years (Lindgardt et al., 2009, p. 3).

The paragraph above argues that a BMI can often turn into a sustainable competitive advantage, and one example of this is Airbnb. Although several international hotel chains could have been able to offer similar or better products and services to those of Airbnb, and easily could imitate their website, user experience, etc., none of them have been able to imitate their BM. Airbnb had managed to at least double their number of bookings every year since its launch in 2009 until 2017, when bookings grew by 62 percent, to 130 million guests (Somerville, 2018). In 2017 they also achieved their first year of profitability.

Incumbent companies with ideas for BMIs must decide whether to embed these in their core business, with the benefits of retaining their assets, customers and capabilities, or to establish the BMI separately. In the case of significant disruptions, the latter might be the better approach.

3.2 Multi-sided Platforms (MSPs)

Together with Airbnb, companies such as Google, Uber, Facebook and Amazon illustrate a recent increase in the number of companies that, without having disruptive product innovations nor process innovation, have managed to disrupt existing industries and threatened global incumbents. Moreover, they all share some characteristics. The mentioned companies are all so-called platform models, connecting several customer groups, and they have all emerged the last two decades and quickly become among the most valuable companies in the world.

As mentioned in chapter 1, a platform in this context is a business that functions as an intermediary between one or more customer groups. This is one form of BMI, and one that has become especially popular with the rise of new technology and digitization. Indeed, many new technologies provide no value for customers unless necessary complements are also made available. These complements might for instance be other market participants. At the same time, an increasing existence of some complements might give customers an increasing amount of value. This is a concept called network effects, which is explained thoroughly later in this chapter, and leads us over to one specific type of BMI: the multi-sided platform model.

Andrei Hagiu is central in the literature on MSPs through his working paper and articles, and we

build upon his definitions and models throughout the development of our framework. Multi-sided platforms (MSP) are technologies, products or services – in short: businesses – that create value primarily by enabling direct interactions between two or more distinct types of customers or participant groups (Hagiu, 2014). Some have described such businesses as two-sided markets, multi-sided markets or just platforms, but we choose to use the term MSP with the understanding of it that Hagiu also uses across several articles.

The two key characteristics of MSPs are, according to Hagiu (2014), that:

1. Each distinct group of participants of the platform are customers of the MSP in some meaningful way.
2. The MSP enables direct interaction between the participant groups.

To help understand these characteristics figure 3.1 illustrates what Hagiu (2014) calls a product platform, a reseller and an MSP. A product platform violates the first characteristic, as the end-customer is not a customer of or affiliated with the product platform. A reseller might fulfill the first condition but violates the second one, as there is no direct interaction between the separate customer groups – such a business creates value by controlling a linear series of activities (the classic value-chain model) (Van Alstyne et al., 2016). An MSP meets both characteristics.

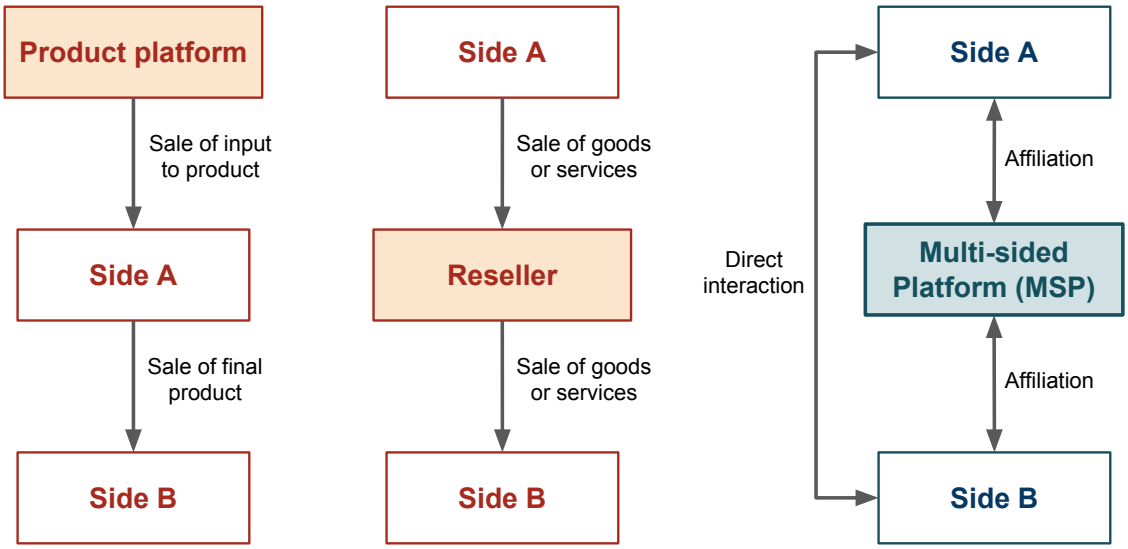


Figure 3.1: How an MSP is different from product platforms and resellers (Hagiu, 2014)

A third important feature of MSPs, is that the value provided to one participant group typically increases with an increased number of participants on one of the other sides, something known as *cross-side network effects*, which we explain more thoroughly in chapter 3.4 (Hagiu, 2014).

MSPs can be both physical, like shopping malls or printed newspapers, or digital, like online search engines, Airbnb, online dating platforms, etc. In either case, the essential platform characteristic is that it facilitates and coordinates the direct interaction between the distinct groups. How it does this might vary from platform to platform, along with many other characteristics. In section 3.4: *A Framework for Analyzing Blockchain-Based MSPs*, we explain the MSP architecture characteristics: network effects, homing costs, switching costs and subsidy side. Also, we explain which decisions can be made regarding the governance structure and revenue model of an MSP.

3.2.1 The Chicken-and-Egg Problem

The perhaps major challenge with all platform models is the *chicken-and-egg-problem*. To illustrate this problem, imagine an online marketplace. It is difficult to attract vendors to a marketplace if there are few buyers. But also vice versa. Until there is a certain amount of participants on one platform side, the other participant side will also have no incentive to join. Usually, this is solved by providing incentives to early-adopters, through subsidizing one or more participant groups, or through that the platform itself takes the role of one or more sides to facilitate transactions (it might for instance itself act as a vendor the first time after an online marketplace is opened).

In their work on platform orchestration, Smedlund and Faghankhani (2015) have created a model to illustrate what they call *the platform loop*. This loop is caused by the chicken-and-egg problem, and has several implications for which modes a platform needs to be in time after time. Our simplified version of this model is shown in figure 3.2. This model neatly illustrates that all the four modes (quadrants) depend on the previous one to be completed in advance. Participants are attracted to join a platform by novel or superior products and services, and new participants enable more transactions to be facilitated. If enough transactions are facilitated, and participants interact enough with each other, they become locked-in on the platform. Then the platform will attract complementors and third-parties to offer yet more novel services on the platform, which again attracts more participants. According to Smedlund and Faghankhani (2015), this is how MSPs can manage to create a self-enforcing loop.

In figure 3.2, the y-axis describes the amount of collaboration between the platform participant groups that is demanded for a platform to succeed in the four different modes. Most novel and innovative products or services are not created in-house, but in a network of many firms (Smedlund and Faghankhani, 2015). Also, new platform participants are typically attracted by the network effects caused by participant interaction and collaboration. On the other hand, to facilitate transactions, and to lock-in participants, is something the platform provider could ac-

complish alone. The former e.g. through a technology or marketplace (e.g. the Airbnb website), and the latter e.g. through increasing switching costs or acquiring competitors.

The x-axis in the figure describes the amount of surplus value the different platform modes create as a result of matching of complementary and interdependent components. The process of attracting participants and facilitating transactions are not directly creating value themselves, and thus scores low on this axis. Locking in participants on a platform, however, makes a platform model more robust, and creates surplus value by reducing the participants' transaction costs. *Transaction costs* are caused by friction between buyers and sellers in a market, explained by their opportunistic behavior. Such friction would be reduced when participants are locked in and controlled (Hollensen, 2007). The lock-in effect would provide security and predictability to all participants. Finally, collaboration between platform participants can create synergies and novel offerings at a higher value than could have been created by each participant separately, thus this mode also scores high on the x-axis.

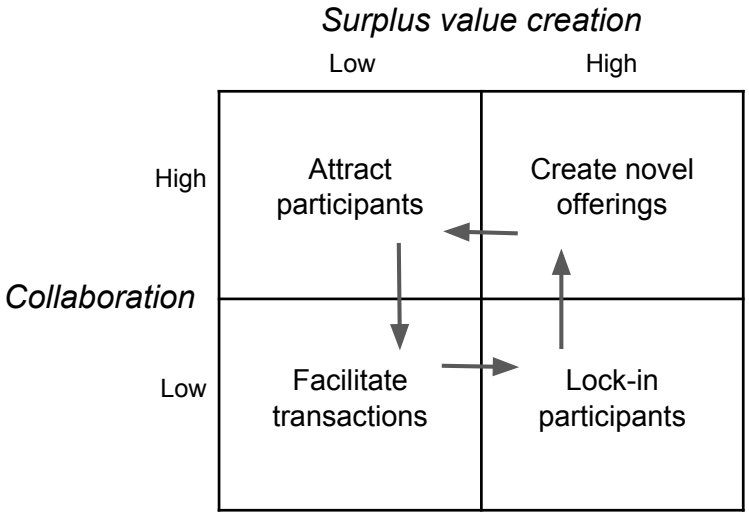


Figure 3.2: The platform loop, illustrating the chicken-and-egg problem. Adapted from Smedlund and Faghankhani (2015)

3.3 Stakeholder Theory

According to Magretta (2002), the purpose of the business model is to create value, and the question then becomes how to maximize this value creation. Value creation, or value co-creation, is especially central for multi-sided platforms, as each platform is a part of an ecosystem where different stakeholders are dependent on each other to create value (Smedlund, 2012). In 1984 Freeman coined the stakeholder theory which tries to answer this question (Freeman, 1984).

Freeman (1984) argues that one must manage stakeholders' requirements in order to create value, and that without the support of the stakeholders, there will be no organization. Value creation may therefore not be analyzed without taking stakeholders into the equation. According to Freeman (2010), a definition of stakeholders to an organization is: "[...] any group or individual who can affect or is affected by the achievement of the organization's objectives." In his paper, Freeman describes four steps for managing stakeholders, which our framework builds heavily on:

1. Identify the relevant stakeholder groups.
2. Determine the stake and relevance of stakeholders.
3. Determine the needs and expectations of stakeholders.
4. Adapt the company to take into consideration stakeholders' interests.

All of these steps can be mapped to steps in our framework, which we describe later in this chapter. We believe managing stakeholders' requirements are particularly important to create value on MSPs, given the fact that platform participants by definition depend on and interact with each other.

Freeman (1984) does not, however, describe *how* stakeholders are to be identified and described. We have therefore used a framework for stakeholder analysis by Brugha and Varvasovszky (2000). According to them, each component of a business should first be identified, and then all stakeholders for each component should be mapped. The full list of stakeholders are then all actors who either are affected by, interested in or have influence on a component. In other words, stakeholders are not only those actors that directly interact with each other on the platform, but also other parties that have an interest in the platform, such as regulators, competitors, and lawmakers.

In his research on stakeholder theory, Jensen (2010) focuses on social issues, and argues that stakeholder theory is not only about maximizing economic value, but also to create social value for stakeholders. Further, value creation is not achieved through a simple statement that the company should try to maximize value. It has to be embedded in both the company's vision

and strategy. This is taken into consideration as we develop our framework. We believe that maximizing value for all stakeholders should be a goal from the very beginning when designing a platform.

In his revision of his own stakeholder theory, thirty years after its introduction, Freeman argues that stakeholders' interests always have to be met, or they will leave the network (Freeman, 2010). However, he stresses that one should not search for trade-offs, but rather seek the balance of joint-interests, and that this is the place which maximizes value creation. Argandoña (2011) agrees with this view, but points out that maximizing economic value for all stakeholders is not the same as giving each stakeholder its maximum value. He argues that value is divided between stakeholders by their relative power. Still, the total value created is larger if each stakeholder is satisfied through cooperative creating of value. He further adds that some stakeholders are not seeking economic value, and there may not necessarily be a conflict of interest to capture this value. We agree with Argandoña, and in our framework we use the stakeholders' relative power to weight the importance of their requirements.

Some scholars consider the stakeholder theory of R.E. Freeman to be contrary to the shareholder theory of Milton Friedman (Sundaram and Inkpen, 2004; Smith, 2003). Friedmans shareholder theory argues that the goal of a company should be to maximize profit for its shareholder, and the company has no obligation to engage in social responsibility (Friedman, 2007). Freeman et al. (2004) disagrees that these theories are in conflict, and argues that since shareholders are also stakeholders, then both theories are right. If one takes the pragmatic view, then all firms need to create value for their stakeholders. If not, then some stakeholders will leave, and there will be even less value created. Even if there are conflicts among the stakeholders, it is in everyone's interest to resolve these without forcing anyone to exit.

The above is especially true for the stakeholders of an MSP, as they interact directly with each other, and are mutually dependent on each other. If e.g. one part leaves a two-sided platform, then the value for the other part will be zero. We therefore consider it important to properly identify all the stakeholders' requirements and design the platform such that it gives them the maximum total value.

3.4 A Framework for Analyzing Blockchain-Based MSPs

The main goal of this thesis has been to create a framework for blockchain-based multi-sided platforms. This framework is based on both previous platform frameworks, as found in literature, and blockchain-specific attributes that are important for the solution architecture, several of which are described in our pre-thesis (Forselv et al., 2017). Also, we have actively used our case study for inspiration and empirical research. In this section we first present the platform frameworks we have been inspired by, then the structure of our framework, and lastly all of the components of our framework one by one.

3.4.1 Previous Work on MSPs

Caillaud and Jullien (2003) argue that many new services with informational intermediation have replaced the traditional "direct sale of goods". Especially after the introduction of the internet. These intermediary services, or platforms, are characterized by the fact that they provide indirect network effects, increasing their value as more actors join the platform. Caillard and Jullien do not provide a clear definition of what a platform is, although it is clear from their writing that it has to provide some network effects.

Rochet and Tirole (2006) has a different and more specific definition. They define a two- or multi-sided platform as a platform which "enables or facilitates the interaction between the two sides provided that they indeed want to interact". Further, they define two-sided markets as transactions between end users and facilitated by a platform. However, their definition of platforms require the use of the platform as a function of the variable and fixed charges on the platform. Their model also differentiate itself from Hagiu's as it is more concerned with the pricing model of the platform and less on the network effects between the end-users achieved through the interaction.

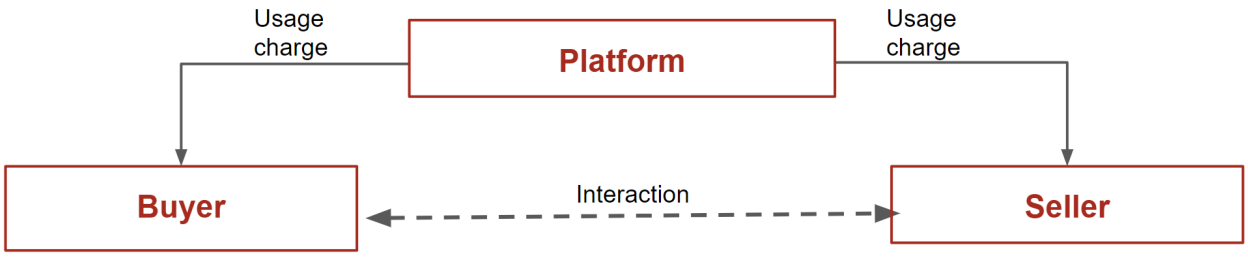


Figure 3.3: MSP model from Rochet and Tirole (2006)

Previously we have explained the different definitions on multi-sided platforms. As shown in 3.3 and 3.4, Rochet and Tirole's model is very similar to Hagiu and Wright's. The main difference seems to be the emphasis on the affiliation in Hagiu and Wright's model versus Rochet

and Tirole's focus on pricing effect from the platform. To create our framework, we wish to further explore Hagiu and Wright's model. There are two main reasons for this: First, the model focus on network effects, which is of importance in our framework to understand how the platform should ideally be designed. Second, Hagiu and Wright's definition require that platforms enables direct interaction. This distinction suits blockchain technology well because of its decentralized nature, and it creates a clear distinction from more linear value chain models.

In their working paper on multi-sided platforms, Hagiu and Wright (2015b) describes in a model how MSPs differentiate themselves from these traditional business models. In the model, the different actors are affiliated with a platform which enables them to conduct direct interactions, and facilitates cross-side network effects.

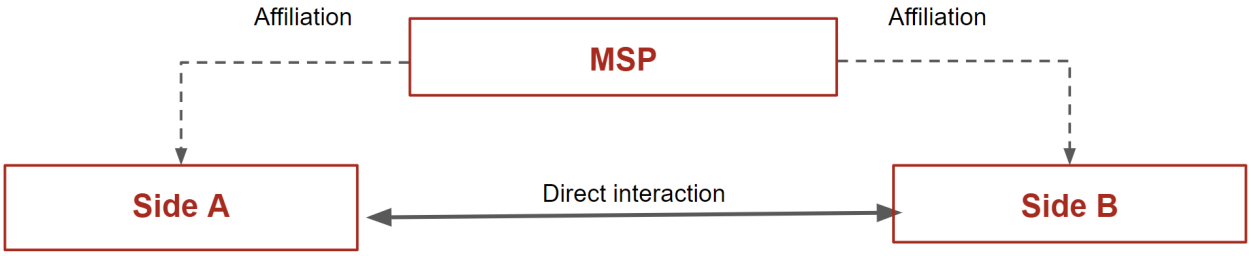


Figure 3.4: MSP model from Hagiu and Wright (2015b)

Kazan and Damsgaard (2013) extend on Hagiu's framework to create a model they call "Digital Payment Framework". The purpose of this model is to analyze digital payment platforms, especially European Near Field Communication (NFC) payment technology. Kazan and Damsgaard do this in their framework by analyzing each stakeholder based on different properties. In sum, the framework can be used to identify and develop platform strategies for multi-sided digital payment platforms. Participants of the platform are analyzed with regards to their homing costs, switching costs and the network effect. The platform itself is analyzed from three perspectives describing the strategy regarding design, technology and bundling choices. The technology solution describes how the choice of technology of the platform is designed to create customer ownership, and to assert control over the customer relationship. Design and bundling choices deals with how open the platform is for development from third parties, and if the platform comes with different offerings in a package, for example is the browser Edge bundled with Microsoft's Windows platform. Figure 3.5 shows the model they use.

3.4.2 Our Framework

Inspired by the way Kazan and Damsgaard (2013) adapted Hagiu and Wright's MSP framework to the Digital Payment industry, we have developed a framework to analyze blockchain-based

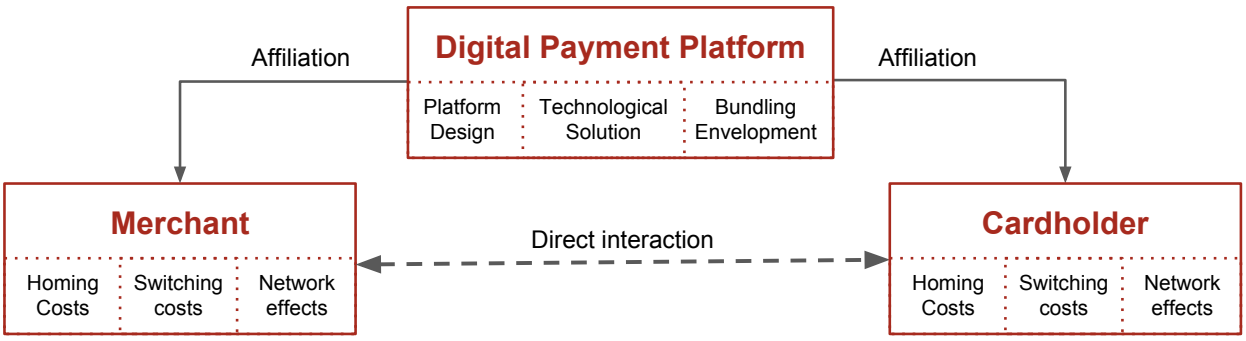


Figure 3.5: MSP model from Kazan and Damsgaard (2013)

multi-sided platforms. Through the model, we seek to build upon previous frameworks for MSPs, but the design follows the ideas from stakeholder value creation. The purpose of the framework is to analyze how value creation can be maximized on MSPs. In this way, we seek to combine literature from both fields to create an adaptable framework. The framework can be used by managers both to design new platforms, and to increase the value creation on existing platforms. It can also be used by both researchers and managers to understand how stakeholders on platforms behave, and which factors influence them.

Whereas Kazan and Damsgaard (2013) chose to extend the model of Hagiu and Wright (2015b), the one consisting of only the actors of the framework, we have instead made a model describing the different aspects of the platform in a "flow model" consisting of four different blocks. The core of the framework is how to create value for stakeholders. From Freeman's articles we see that stakeholder analysis is a central part of value creation (Freeman, 1984; Freeman et al., 2004; Freeman, 2010). We have therefore built our framework around Freeman's model for stakeholder analysis, but combine this analysis with platform-specific and technology aspects of MSPs from Kazan and Damsgaard. We have, however, made some modifications from that of Kazan and Damsgaard (2013).

In Kazans and Damsgaard's model, the technology is designed to assert control over the customer relationship. We flip this perspective, and through the idea of stakeholder value creation, we say that the technology choice should be made based on what maximizes value creation for stakeholders. The technology should therefore be chosen after a thorough stakeholder analysis. In their model, they also describe how bundling can be used in the platform design as a strategy to give the platform additional value. This is an interesting perspective, but again we flip the perspective, and see this as something that should come as a result of the stakeholder analysis the stakeholders' needs. .

Further, the model of Kazan and Damsgaard (2013) includes an analysis of participants on the platform, however they only look at participants actually using the platform, and not the whole

ecosystem. As seen in the works of Freeman, platforms need to take the whole stakeholder ecosystem into consideration (Freeman, 1984; Freeman et al., 2004; Freeman, 2010). In our model, we therefore include all indirect participants in our analysis of stakeholders.

As described previously, this model consists of four parts. These are: Business Idea, Platform Architecture, Blockchain Architecture and Solution Architecture. The model is defined in chronological steps from the business idea to the whole solution architecture of the framework is designed. The model builds around a stakeholder analysis, where the analysis from the first parts of the model results into the last block of the model, the solution architecture, which is designed for maximum value creation for the stakeholders. The purpose of this layout is to make the analysis more intuitive, as the analysis is conducted in logical steps where the choices of the previous step affects the next. Each step contains different features and properties that correspond to its category, and we have structured the framework into four different component groups as seen in figure 3.6.

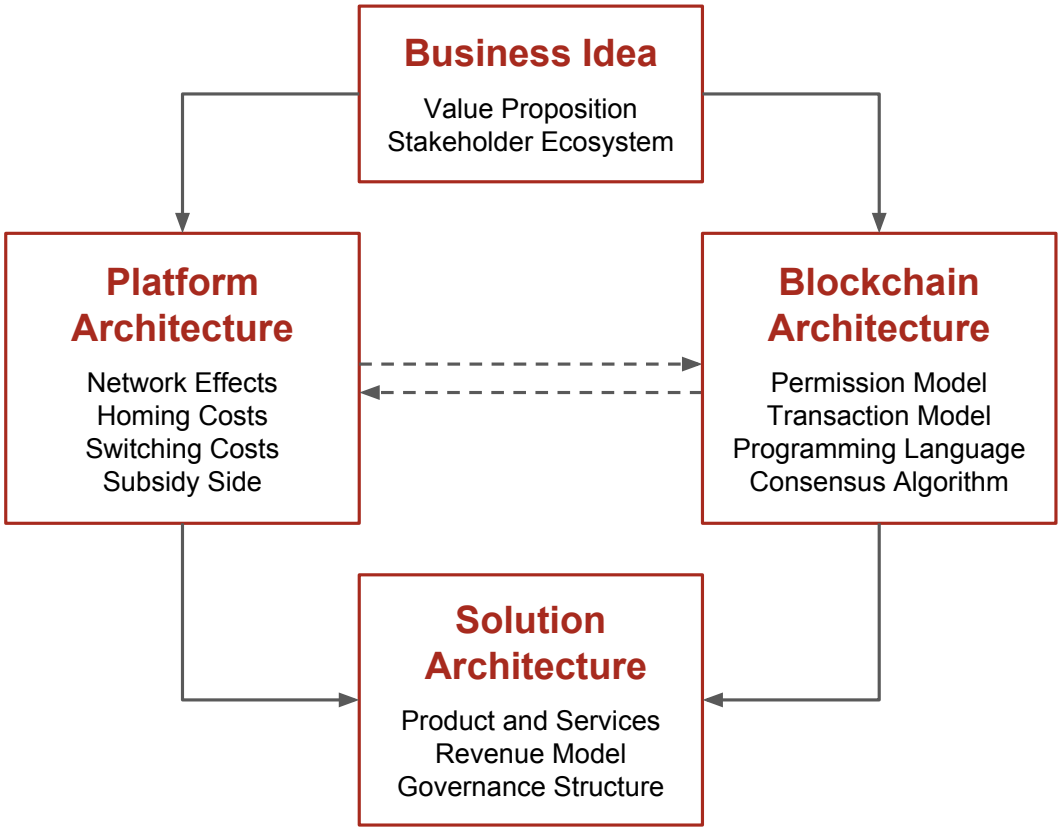


Figure 3.6: Framework structure

A notable difference from the model of Kazan and Damsgaard (2013) to our framework is our step-solution and our emphasis on technology. Kazan and Damsgaard's model includes a com-

ponent about technology, but we expand on this and further specialize it to be about blockchain architecture. This technology architecture is further separated into several sub-components, making our framework more technology specific. If our framework is to be adapted to other technologies, this framework component could be replaced by a more general technology block or with sub-components suitable for the relevant technology. It is important, however, to emphasize that the technology-choices are dependent both on the platform architecture and the stakeholder analysis. And together these two architecture blocks pose the foundation for the final block, the solution architecture.

Comparing our framework to the stakeholder model of (Freeman et al., 2004), one can see that the first block, Business Idea, covers Freeman's first two steps in a stakeholder analysis: identifying the relevant stakeholders and determining stakeholders relevance. Both the architecture blocks in our framework cover the third step: to determine the needs and expectations of stakeholders. Finally, our last block, solution architecture, covers the fourth step: to adapt the platform to take into consideration stakeholders' interests. This part of the framework suggests a product, pricing and governance structure based on the stakeholders' needs and expectations.

Now we turn our attention to the specific parts and components of our framework. To explain and illustrate the importance of several of them, we use the example of an online marketplace with buyers, sellers and advertisers as its different participant sides.

3.4.3 Business Idea

The first step in the model is the business idea. The business idea should ideally describe which problem it solves, and for whom. In other words: the value proposition of the business, and in which stakeholder ecosystem it acts.

Value Proposition

A *value proposition* is a promise of value to be delivered to customers who buy or use a product or service, in this case to any customers of a platform. This is what should convince potential customers to complete a purchase or transaction. As an example, the value proposition of an online marketplace would typically be to connect buyers and sellers, and perhaps to provide a secure and easy form of payment, filter out fraudsters or similar (i.e. products and services). This part of the framework should consist of a summary of what value the platform offers and to whom.

Stakeholder Ecosystem

The goal of this part is to first map the whole stakeholder ecosystem and to then define and describe each stakeholder. The former is done using a framework described by Brugha and Varvasovszky (2000), as mentioned earlier. The latter is done according to step one and two of the stakeholder theory developed by Freeman (1984). When completed, this information can be used as input in the next two architectural steps.

3.4.4 Platform Architecture

The platform architecture consists of six different features. Each feature describes an effect or a cost for the actors on the platform. By understanding how stakeholders are affected, it is possible to deduct what would be the ideal design of the platform which meets all stakeholders requirements and maximizes the economic welfare. This covers the determination of needs and expectations of stakeholders from Freeman.

Network Effects

Network effects are when the value provided to one participant group increases or decreases due to an increased number of participants on one of the sides of the platform. When the number of buyers using the platform increases, the value for advertisers – a separate participant group – increases. This is known as *cross-side network effects*. In the same example, however, if the number of sellers significantly increases, there might be a negative *same-side network effect* for the existing sellers on the platform due to increased price competition (Kazan and Damsgaard, 2013).

Homing Costs

Homing costs are all the expenses for participants to use a platform, including both actual expenses, time spent and opportunity costs. According to Kazan and Damsgaard (2013), these costs include three cost components, from each of the separate stages of a participant journey: *Upfront costs* are the costs connected to search (finding the platform), training, adapting to the platform and the initial investment (e.g. creating an extensive seller profile on the online marketplace). *On-going costs* are expenses for maintenance and membership fees. *Exit costs* include termination costs and the difference between up-front investment and the salvage value of any purchased hardware or software.

An important fact to reflect on here, is that when homing costs are low, as for instance is often the case with online marketplaces and credit cards, this increases the chance of *multi-homing* participants – using several separate platforms simultaneously – and frequent switching.

Switching Costs

Switching costs are nearly related to homing costs, but specifically those costs platform participants face when switching to another platform. These are high if participants have made large investments either into the platform (for instance when sellers have built up a good reputation or brand on a online marketplace), or into complementary assets (homing costs). High switching costs create what Shapiro and Varian (1998) call a *lock-in effect*.

A somewhat different type of switching costs is what Parker et al. (2016) calls cross-side switching costs, which is relevant for many types of platforms. This is the costs for a platform user to switch between the different platform sides, for instance from being a buyer to becoming a seller on an online marketplace. Low cross-side switching costs could increase users participation on the platform.

Subsidy Side

Often, platforms have one or more participant groups that are subsidized by the platform provider in order to achieve positive network effects. In the online marketplace example, buyers might get free rewards if they register on the platform, or free shipping, as more buyers on the platform will lead to positive network effects for the two other sides of the platform: sellers and advertisers. And as the observant reader then might then have deduced: either one or both of the other groups would then necessarily have to be the *revenue side*, providing income for the platform provider, if this strategy is to be profitable. Subsidizing might happen for a limited period or indefinitely.

3.4.5 Blockchain Architecture

Within blockchain technology there exists several different architectural designs. In our literature review we identified a set of architectural designs which is present in each blockchain-based ledger. A blockchain-based platform would have to make a conscious decision for each of these, and all of them could have a have a lot of impact on the usage of the platform. Therefore the following design choices should only be made after a careful analysis of the business idea, stakeholders, and platform architecture.

Permission Model

According to Hein et al. (2016), an important mechanism in platform governance is along the dimensions of accessibility and output control. *Accessibility* is about who should have access to the platform, whether or not there should be any restrictions on participation and whether or not the platform should be open or closed. An example is if an online marketplace only is

open for certain companies or products, or if users need to register some information to gain access. *Output control* is defined as a pre-specification of principles for evaluating, penalizing or rewarding the output of a platform participant (Hein et al., 2016). On online marketplaces, for example, users are often allowed to rate other participants and write reviews after having made a trade. Also, sellers are often ranked according to their number of trades.

A *permission model* defines how access to the ledger is managed, and which users are allowed to conduct operations on the ledger. In general there are two different types of permission models: permissioned and permissionless. These terms are sometimes interchangeably mixed with the terms closed and open blockchains, or private and public blockchains. The terms permissioned and permissionless describe the properties of interest for our model most correctly, hence we use them. Most blockchains considered open are also permissionless, but this is not always the case. For example, some blockchains are open and permissioned at the same time, such as Ripple.

There are three major permissions that must be configured for any ledger, as explained by Hileman and Rauchs (2017):

- *Read-permission:* who can access the ledger and see transactions.
- *Write-permission:* who can generate transactions and send them to the network.
- *Commit-permission:* who can update the state of the ledger.

In a *permissionless blockchain*, anyone is allowed to read, write and commit to the ledger, as long as they follow the rules of the protocol. This means that anyone can join the blockchain network, and participate in validation and creation of blocks and transactions.

A *permissioned blockchain* is a ledger on which participants are selected by the ledger owner(s) (Walport, 2016). A permissioned ledger may have different combinations of read-, write-, and commit-permissions. For instance an MSP could allow anyone join the network, read the ledger and write transactions, but keep the control over the updating of the ledger to itself and thus act as a central point of trust.

The choice of permission model is important for the platform. If the platform chooses to use a permissionless blockchain ledger, it gives up its control over not only who that has access to the ledger, but it also cannot do any moderation, such as to punish malicious actors or to reverse erroneous transactions. Put simply, it gives the public community the power to moderate the platform, which requires a suitable consensus algorithm. An advantage of this is that it enables a larger community to contribute with changes and ideas, which may be more effective than if controlled by the original developers of the platform. The platform creator does not necessarily

give away the power to develop the platform. As an example of this, the open Ethereum network is a permissionless ledger, but most changes implemented are proposed by the Ethereum Foundation.

To illustrate the influence the choice of permission model can have over the platform model, we have adapted a model from Iyer and Henderson (2010). This model describes MSPs and other platforms along two dimensions. The value of the model is that is shows how the platform relates to complementary products. A platform can be either open or closed, and it can be moderated or free. Closed platforms exclude third parties from the platform and/or any modification of it, whereas open platforms welcome them and might even be open source. Where a platform is located along this axis determines the degree of involvement of third parties on the platform. Equivalently, the location along a second axis determines to which degree complementary products/services are able to integrate with a product/service. The extremes on this axis are free and moderated platforms, the former which is without rules and the latter with some rules for control.

Through the two above described dimensions, one can differentiate between different platform design strategies related to complementary products and services. These can be illustrated as following, with example platforms in the four strategy quadrants:

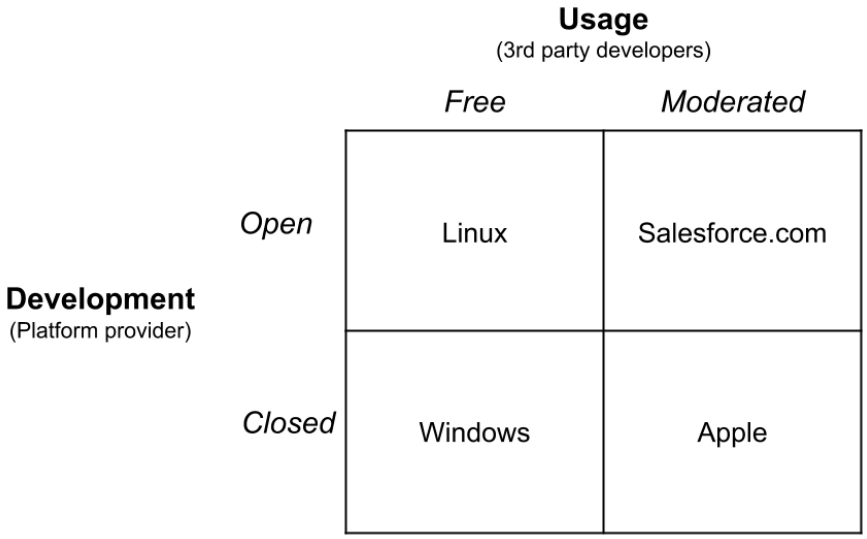


Figure 3.7: Platform design model, adapted from Iyer and Henderson (2010)

Verification and Consensus Model

One of the criteria/characteristics for Blockchain ledgers is that the ledger is distributed between several nodes, and that there is a consensus on the state of the ledger. A blockchain plat-

form therefore needs to have a mechanism to ensure that such a consensus is reached.

In permissioned ledgers where actors can be trusted, Byzantine Fault Tolerant algorithms are popular. Byzantine Fault Tolerance (BFT) is when a system is able to reach function even if parts of the system is behaving faulty, either due to an error or a malicious act. In consensus algorithms, the system must be able to reach consensus even if some nodes are sending no message or sending incorrect messages. *Practical Byzantine fault tolerance* (PBFT) is an example of such an algorithm that can reach consensus in a decentralized network (Castro et al., 1999). An advantage of BFT algorithms is that they are both quick and robust.

The picture is more complicated for permissionless ledgers. In addition to reaching consensus, the network needs to have a protocol to verify transactions and to create blocks. Unlike permissioned networks with centralized commit permission, that is, where only one or a few nodes are allowed to commit (create blocks), permissionless ledgers must combine the consensus algorithm with commit permission. The most common way to do this is through Proof-of-Work or Proof-of-Stake, although many more methods similar to these exist.

Proof-of-Work (PoW) is a proof that some computational work has been done. A PoW is typically data which is difficult to compute, but easy to verify that is correct. PoW is used in many blockchain ledgers, such as Bitcoin, to decide who is allowed to create the next block in the chain. In cryptocurrencies, creators of blocks that are used in the blockchain receive rewards, and this incentivizes them to act lawful, so that their blocks are indeed used. It is important that the PoW algorithm gives a random output for each computation, such that the chance of receiving the permission to create new blocks should be proportional to the amount of computing power one has. A disadvantage of PoW is that it consumes a lot of energy to perform computations. Bitcoin is estimated to consume 30 TW/h per year globally, which is as much as the country Oman or about one-fifth of Norway (Digiconomist, 2017).

Proof-of-Stake (PoS) use special nodes called validators to create new blocks. They take turns to do this, and they also vote on blocks to validate them. The weights of the votes of the validators depend on the size of their staked deposit in the network, which in the example of cryptocurrencies would be limited by the amount of the cryptocurrency the validators have accessible. A benefit with PoS compared to PoW is that less energy is wasted on computation. A challenge with PoS is the “nothing-at-stake” problem where in case of a fork, validators do not suffer any consequences if they vote on several of the blocks in the fork (whereas PoW is resource constrained and costly, thus actors need to prioritize their resources, i.e. computing power) (Ethereum Foundation, 2017).

A blockchain-based MSP would have to decide on which type of consensus algorithm it wants.

If the commit permission is controlled by the platform, a simple BFT algorithm should be used. An open commit permission, however, has some important implications for the platform architecture. If algorithms such as PoW or PoS are used, the miners or validators have to be incentivized in a way, as there is a cost involved with running the nodes. This can either be done by having a fee on each transaction, which the miners collect when creating new blocks, or miner might receive a sum from the platform itself for each block they create. In any case the platform would need to have a token, or a cryptocurrency, to pay the miners with. The platform's choice of consensus model is therefore heavily dependent on the stakeholders' willingness to pay.

Transaction model

Platforms need to decide which technique they want to use to handle transactions. In general there are two different methods: To use account balance based transactions, and the Unspent Transaction Output (UTXO) model.

The UTXO model was introduced with Bitcoin, and is popular among several cryptocurrencies. In this model, assets ownership is represented as UTXOs, which can be compared to the cash economy. For each transaction, the input to the transaction has to be one or several UTXOs from the sender. These UTXOs are spent in the transaction. The output of transactions are also UTXOs, but new ones. For example, if Alice wants to transfer 13 coins to Bob, Alice may use for instance a 10-coin UTXO and a 5-coin UTXO as input. The output is then a 13-coin UTXO to Bob and a 2-coin UTXO to Alice.

Account-based ledgers are an alternative to UTXO. In account-based ledgers, there is a global state storing all accounts and their balances. This system resembles the system of bank accounts, in which every person has one or more accounts, and where transactions are updates of the state of accounts, where the sum before and after the transactions is equal. For example, Alice transfers 10 coins from her account X to Bob's account Y. Alice then sends a transaction where her account is deducted with 10, and Bob's account is increased by 10.

The UTXO model has two major scalability benefits. First, they may be validated in parallel. Second, the model does not require participants to keep the entire blockchain state, but only to keep control of the UTXOs, which reduces memory usage. A benefit of the account-based model is that transactions require less space, as there is always only one input and one output, not several of them. Another benefit with account-based transactions is that such a system is easier to develop.

The question on which transaction model the platform should use depends mostly on if it requires high scalability or not. If it does not, then adopting an account based model would be the easiest choice. As this design question affects aspects mostly "under the hood" of the platform,

user preferences are usually not important.

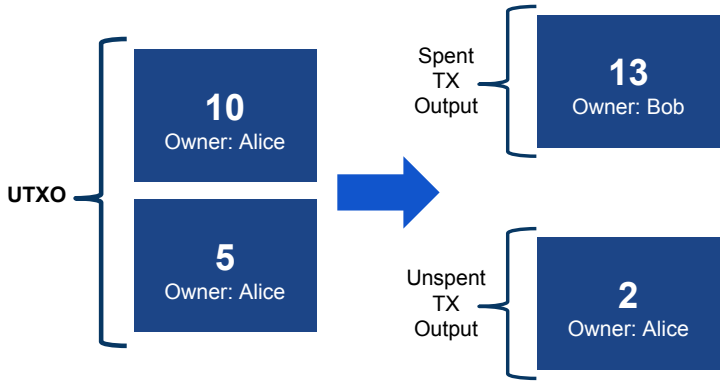


Figure 3.8: Illustration of our UTXO example: Alice sends 13 coins to Bob

Programming Capabilities

The last component of our blockchain architecture that platforms must decide if they want to offer is scripting, and if yes, then using which programming language. Scripting can be used to run computer programs, often called "smart contracts", on the ledger. With smart contracts, it is e.g. possible to program simple trade contracts where two assets are exchanged. Moreover, depending on the programming language, it might also be possible to create more complex programs such as elections and future contracts. In essence, the complexity of the programming language is the limitation of which business logic is possible to reflect in smart contracts.

Smart contracts may be divided into two categories: stateful and stateless contracts. *Stateful smart contracts* can maintain an internal state. This means it may perform loops and recursions, and interact with other parts of the blockchain or outside systems. A benefit of stateful smart contracts is that they are able to run advanced contracts. In contrast, *stateless contracts* are faster and more secure, as they are less complex.

Platforms must decide if they want to use an existing programming language or invent a new one. A new one gives more flexibility to implement the specific capabilities they want to offer, but it requires a lot more development than simply adapting an existing one. These choices are mainly answered by the platforms' business model, and as development is costly, the platforms need to analyze if actors on the platform really require such specific scripting capabilities, and to which complexity. Typically a platform that simply offers transactions from Alice to Bob would not need complex scripting.

3.4.6 Solution Architecture

The solution architecture overall should define how the final business idea of a platform should look after analyzing the platform according to our framework. Stähler (2002) defines a framework where businesses can be analyzed through four components. Two of these are relevant for this final part of our framework: products & services and revenue model. Moreover, once the architecture analysis has been conducted, one can decide on an architecture and governance structure based on what gives most value to stakeholders and what is possible from a blockchain perspective. This covers Freeman's step of adapting platforms to stakeholders. This leaves us with a final solution architecture that includes the two mentioned framework components: products and services, revenue model and governance structure.

Products and Services

After considering stakeholders' requirements, a platform needs to decide which products and services it can offer its users given the capabilities and constraints of its blockchain architecture. This part should be a list of which products and services that can be offered, with evaluations of how they fit the framework and platform's BM, and in which manner they are offered.

Revenue Model

A revenue model is the sources and type of income for a platform. There are several models to choose from such as subscription fees, "freemium models" (the most basic services are free of charge, but additional ones are not), entry fees, a constant fee per transaction, a percentage of transactions etc. The revenue model can be chosen based on what gives most value to which stakeholder, and how this fits with the chosen blockchain architecture. For example, if retailers on a platform receive more value from the platform than any other stakeholder group, they might be willing to subsidize the other stakeholders' use of the platform with a subscription fee or a percentage of each sale. Such a solution does not require any complicated blockchain architecture for consensus or transaction models. However, if stakeholders want a decentralized platform where it is not clear which actor is willing to pay the most, the platform might have to contain a cryptocurrency where transactions are verified and committed by miners. In any case, the revenue model is dependent on the stakeholder analysis and blockchain architecture.

Governance Structure

Governance Structure is a question of whether to have centralized or diffused governance. The platform governance then entails how the authority and responsibility for each class of *decisions rights* is divided between the platform owner and module developers. The platform's *ownership status* defines whether a platform itself is proprietary to a single firm or shared by multiple owners (Hein et al., 2016).

Chapter 4

Methodology

This chapter presents, discusses and evaluates the methodology used in our work with this thesis. More specifically, we discuss how we decided on the relevant literature, the background for our research strategy, how the research was designed and the data gathering conducted, and finally, the validity of our study along with the limitations of it.

4.1 Research Strategy

As mentioned in section 1.4, we have chosen a research methodology for this thesis called systematic combining. Although we introduced the method there, we go more detailed through it below. Also, we go more into detail about our strategy for doing our case study, before we finally discuss how we decided on relevant literature.

4.1.1 Systematic Combining

Case studies provide a way of developing theory by utilizing in-depth insights and observations of empirical phenomena and their contexts, at the same time as theoretical literature can allow for more simplified and bounded learning about issues (Yin, 2003). Systematic combining is a method characterized by continuous movement between such an empirical world and a theoretical model world, and Dubois and Gadde (2017) find that this method is able to expand researchers' understanding of both theory and empirical phenomena.

Figure 4.1, adapted from Dubois and Gadde (2017), illustrates the basic ingredients in systematic combining, those that we have focused on in our research. The objective of our research has been to match theory and reality, through confronting theory we find with empirical facts from the real world. We have used *theory* from literature and previously created frameworks to develop our own *framework*, and through our specific Startblock *case* study as well as surveys

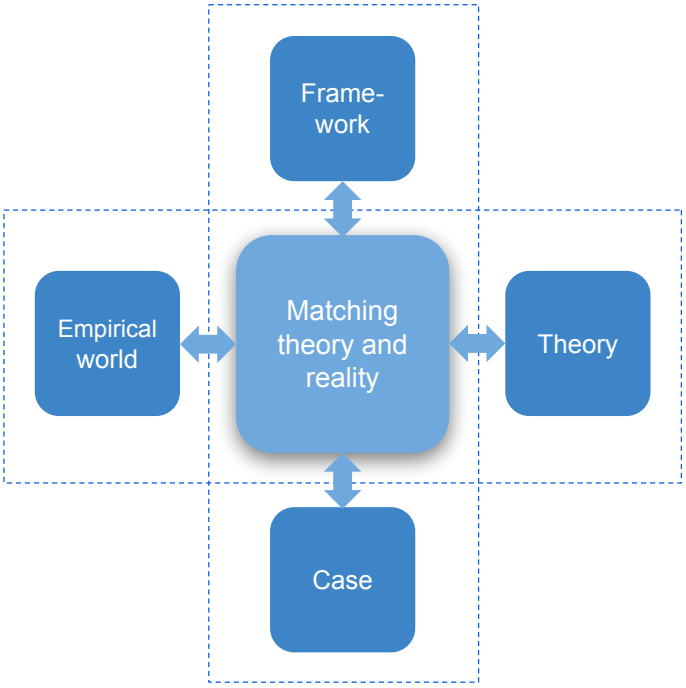


Figure 4.1: Systematic combining

and interviews we have gathered data from the *empirical world*. In the description of systematic combining as a method, Dubois and Gadde (2017) emphasizes the fact that one must use all these ingredients in parallel, going back and forth. This means that our framework had to be gradually evolving, allowing for changes and updates as we found new theory and made empirical observations (e.g. through interviews we conducted).

Our objective with using systematic combining as a research method was to combine what we found to be an exciting theoretical problem with an interesting real-world case. This method reduces the chances of falling into the trap of e.g. richly describing theory without actually coming to any practical conclusions, or that one just uses one or several case studies like if they had any statistical generalization. Both of these mistakes are common in case study research according to Easton (1995).

4.1.2 Case Study Strategy

According to Yin (2003), the key factor to consider for differentiating among various research strategies is to identify the type of research question being asked. The key is to understand that research questions have what Yin calls both substance, for example: what is my study about? And they also have form, for example: am I asking a "who"-, what"-, "where"-, "why"-, or "how"-question?

A survey will often be suitable to answer "what"-questions. In contrast, "how"- and "why"-questions are more explanatory and, according to Yin (2003), better answered using case studies, histories, and experiments as research strategies. One argument for this is that the latter two types of questions are often related to happenings and changes over time, not only a frequency or other one-point metric. Although case studies are similar to histories, they add two sources of evidence that are usually not used in historical studies: direct observation and systematic interviewing. And differently from experiments, case studies are not conducted in isolated and controlled environments.

From the very beginning of our work with this thesis, our ideas for research questions were more focused on the "how" than "what". Also, in contrary to our earlier research, for our project thesis, we this time wanted to research a problem in real-life context. It thus quickly became clear that a case study would be a suitable approach for us – even before we decided on using systematic combining. Yin (2003) includes a technical definition of case studies, in which he writes that case studies are empirical inquiries that investigate "a contemporary phenomenon within its real-life context", especially "when the boundaries between the phenomenon and context are not clearly evident", but the context, however, is indeed relevant. This fits well to our research questions; it is not clear how business models influence the success of blockchain-based companies, but we are certain that they are relevant.

In complex contexts, surveys have the problem that there are too many variables to consider, and experiments have the problem that there are too many variables to control. A case study, however, can use quantitative as well as qualitative evidence (Yin, 2003). We decided early on to combine the two of these, and to use what we thought to be the appropriate methodology for any of the stakeholder groups we wanted to collect data about. In section 4.2: Research Design, we describe our research methodology more detailed for each one of them.

4.1.3 Deciding on Relevant Literature

Freeman has been central in stakeholder theory after he wrote "Strategic Management: A Stakeholder Approach" Freeman (1984), and he has been called the "father of stakeholder theory" (Laplume et al., 2008). When looking for literature on stakeholder theory, we therefore read several of Freeman's papers, among them a summary of what other researchers had written on the topic (Freeman, 2010), and further investigated literature actively referenced by them.

The literature on blockchain technology used in this master thesis builds on our project thesis (Forselv et al., 2017), in which we conducted a comprehensive systematic literature review. The

choice of studying business model innovation and platform models was made together with Blockchangers AS, after considering several ideas on what parts of business strategy that would be interesting to consider in combination with blockchain technology. We further believed that the MSP model is well suited for utilizing the opportunities provided by blockchain-based products and services.

Our choice of business strategy theory has been done in close cooperation with our supervisor, building on her knowledge of the field. Other literature has been found after advice from or discussions with Blockchangers AS, in addition to some that we found when looking through the curriculum of strategy and business courses at NTNU that our master program builds on.

4.2 Research Design

For our theoretical research we conducted a literature search on "multi-sided platform" and the equivalent without the hyphen. We used the Scopus database (`www.scopus.com`) and got approximately 100 results for this. Further, we used the snowballing technique, i.e. tracking down much used references in these articles, to add to our article base. Much of the literature we added was about platform models in general and two-sided markets. We then read all congregated material and rated all articles according to their importance for MSP research, removing those not relevant, and thus giving ourselves an MSP library and a good overview of essential literature on the topic.

For our case study, we used Blockchangers AS, the entrepreneurs behind the Startblock business idea, as a discussion partner. Also, we got their first version of a business plan for Startblock. To refine our framework and to be able to design an optimal solution architecture for Startblock, we had to identify the requirements of the Startblock stakeholders to the platform.

A challenge when gathering information from Startblock's stakeholders for answers on how to design our framework, is that the stakeholders are very diverse and with different knowledge and interests. A complicating factor is that the different stakeholders' knowledge of our framework content was generally weak, and especially when it came to the blockchain part of our framework. Therefore, we had to translate any blockchain-related requirement questions into questions that made sense for stakeholders.

4.2.1 Stakeholder Value

The goal with our framework is to enable researchers, managers, entrepreneurs and others to analyze existing MSPs, or to design optimal solution architectures for new MSPs, such that the value creation can be maximized for their stakeholders. In order to achieve this, one first needs to find out what the stakeholders of an MSP actually value. To do this for our case study, we decided that we needed information about at least the following three categories:

- Which products and services will give the stakeholders value?
- Which platform architecture is most beneficial for each of the stakeholders?
- Which blockchain architecture would be most beneficial for each of the stakeholders?

To answer the first question above, which defines what the platform should offer, one needs to find out which types of products and services are of interest for one's stakeholders. For our case study, Startblock, we did this by creating a range of questions related to each of the products and services we knew Startblock considered to develop or offer. These questions could then be asked to our stakeholders during our data gathering process. A similar process was followed to answer the second and third questions above, which are in accordance with the mid-step architecture blocks of our framework. To answer them, and their sub-components in the framework, we mapped each of them to one or more detailed questions that we needed answers to. In table 4.1 we show an excerpt from our mapping from framework to questions for one of Startblock's stakeholder groups, the small-scale savers. We provide this example to illustrate our way of reasoning, and all of the final questions can be found in Appendix C.

With questions readily defined to find out what the stakeholders of Startblock valued, we went on to collect data, in this case through conducting interviews and a survey. The format of these are described in the next sections. To summarize, we investigated what each stakeholder valued through identifying detailed questions related to each of the components of our framework, and then answered these through data collection directly from subsets of the stakeholders.

Value for Small-scale Investors and Angel Investors

We assume investors to be mainly interested in monetary values. For them, value can thus come in two ways: through increased ability to earn money or through reduced costs. From this perspective, we defined value creation on the platform for them as something that would reduce their costs associated with investing, or the time it takes, or that the platform could provide them with new and interesting opportunities to invest in. The questions for small-scale investors and angel investors were similar, but somewhat different because we collected data from the groups through two different methods: a survey and interviews, respectively. The next sections will go into details about these.

Table 4.1: The mapping process from framework categories to stakeholder questions, for small-scale investors (excerpt).

Category	→	Question we needed answered
Products & Services		
Startblock Cap table	→	How much value would a digital cap table provide for small-scale investors?
Startblock Marketplace	→	How interesting would it for small-scale investors to be able to trade unlisted stocks?
Startblock Portfolio	→	How much value would a stock portfolio feature give small-scale investors?
Platform Architecture		
Network Effects	→	How much value is there for small-scale investors that many other small-scale investors also use the platform for investments? How much value is there for small-scale investors that many startup companies also are on the platform?
Homing Costs	→	How much are small-scale investors willing to pay upfront to join the platform? How much are small-scale investors willing to pay for the use the platform? Which pricing model do small-scale investors favor the most?
Switching Costs	→	How much time and money would small-scale investors have to spend on the platform before they would prefer staying rather than moving to a competing platform even despite better offers? How much is the cost for small-scale investors to also register their own company on the platform? (Cross-side switching cost)
Blockchain Architecture		
Permission Model	→	Is it important for small-scale investors that the platform is open to anyone? How much degree of moderation should there be on the platform? How should key management be handled?
Transaction Model	→	How long delay can there be on the network until transactions are finalized? Do users need accounts to get a better overview of their assets?
Programming Language	→	Should the platform offer smart contracts? How many transactions per second should the network be able to handle?
Consensus Algorithm	→	Should the platform have miners? Will there be malicious actors on the network How much degree of moderation should there be? Is it important that the transactions are finalized?

Value for Startups

Value is similarly measured for Startups. On the platform, they would gain value if they could raise more money, develop their business, keep shareholders satisfied, reduce costs or save time. Our knowledge gap for startups was therefore first and foremost understanding their motives around funding, if any of the products on the platform could lower their costs, and if being listed on the platform could somehow help or prevent them developing their business.

Value for DNB

As a bank and investor, we defined DNB's value as monetary as well. Our interpretation of this economic value was not that DNB had to receive revenue directly from the platform, but that their involvement in the platform was to achieve a financial gain, directly or indirectly. The latter could for instance be through retaining more of their customers or attaining new ones.

Value for Regulators

The regulators are in a special group. For them, we did not measure monetary value in the same way as for the other stakeholders, but rather how well the platform meets regulatory requirements. The purpose of the governmental regulators are to make sure organizations are following the same rules in the market. We did the assumption that lawmakers want their regulations to not be an unnecessary economical burden for organizations, nor that it should be expensive for the government to enforce them. Value would be created for them if for instance more organizations would comply with their requirements, or if they would get better data about which companies and individuals that do and how that do not.

4.2.2 Interviews

Our interviews were conducted in a way Brinkmann (2014) call semi-structured. This means that we have had a list of questions we wanted answered, but the interviews have been an open conversation with the interview subject, where we have allowed the subject to talk quite freely. The main benefit of this, and the reason that we chose this method, is that the subjects were more experienced in their field than we were. By not following a structure too strictly, we gave subjects the opportunity to spontaneously provide us with information and narratives that we had not thought about.

In our interviews, a better understanding of the needs and requirements of our stakeholders were much more important than obtaining a single number. As explained in section 3.1, we have focused on the narrative test of our case study's business model, not the numbers test. Through obtaining a better domain knowledge and understanding of the stakeholder's situation

we could update and further develop both our framework and case study analysis. We therefore used interviews as a method when we interviewed subject matter experts, and when we wanted the possibility to receive more information from the interview subjects. The stakeholders we assessed to fit into this category were angel investors and key employees in startups. Among the all the startups we could have chosen to interview, we chose to prioritize startups with experience from crowdfunding, as they were found by Blockchangers to be the type of companies to receive the most value from using the platform (Blockchangers, 2018).

We interviewed five Norwegian angel investors as well as key employees from five different Norwegian startup companies. Most interviews were conducted by two interviewers. Interviews were preferably done face-to-face. This had two benefits: First, it is easier to form a personal connection with the subject when meeting in person. This makes it easier for subjects to be more relaxed and to be open and spontaneous. Secondly, we avoided the possibilities of technical problems with communication. Interviews through online video meetings have a longer delay, and sometimes technical problems break the flow of the interview. All interviews not conducted in person were done through video conference or audio call. Notes were taken during the interview. In addition, most interviews were recorded both in case we did not manage to note all facts of interest, and for the third person of us, not present, to be able to go through it afterward. This person could then make his own notes and then compare them to those taken during the interview, and this way look for any misunderstandings or differences in our interpretations. A full list of all our interviews, their form and duration can be found in Appendix B.

4.2.3 Survey of Small-Scale Investors

When identifying how to get information from small-scale investors, we realized that most questions regarding blockchain design would not be best answered by the small-scale investors directly, but rather through understanding the value proposition the platform chose to have towards small-scale investors. We therefore decided to collect this information from Startblock AS. However, for most of the questions concerning the platform architecture we could get valuable input directly from small-scale investors.

We preferably wanted to conduct qualitative interviews, since, as mentioned in the previous section, we did not know all information beforehand and wanted respondents to provide us with more knowledge. However, for small-scale investors interviews were not an option as the stakeholder group is very large, and interviewing them all was unfeasible. Further, we did not know much about how an average small-saver looked like, so finding the right candidates to interview would be difficult and we risked ending up with misrepresented information. We therefore assessed that we would have to do a quantitative analysis, as this would give us not only a better

understanding of the small-scale investors requirements, but also an understanding of small-scale investors as a group. We were curious to understand if it was even possible to label them as a distinct group.

According to Cooper et al. (2006), the advantages of conducting web-based quantitative research is that participants can be anonymous, which give more honest and correct results, and that there is a short turnaround on results, which gives us lots of answers in a short time, which further increases the accuracy. However, Cooper et al. (2006) describes that disadvantages are that questions must be unambiguous, and that the web survey itself must be technically easy to respond to, as there are limited possibilities to support respondents. These factors may affect both the response rate and the accuracy.

Having a lot of data was important for us, as we suspected the respondents could be a diverse group, and we therefore landed on using a web-based survey. We created the questions for the survey in a comparable manner as we did for the interview guides. We first translated platform questions into attributes of the small-scale investors, and then created questions which could help us understand these attributes. Our strategy was to reach as many small-scale investors as possible, and to sort out noise from the data afterward. We did this by distributing the surveys on several Norwegian web forums for investors and small-scale investors. This exposed the questionnaire to many people, and in total we got 142 responses, 105 of which had answered more than 10 of our 26 questions.

Table 4.2: Forums where the survey was shared

Discussion Forum	**Responses**		**> 10 answers**	
Hegnar	12	(8%)	11	(92%)
Shareville - in two separate groups	54	(38%)	45	(83%)
Xtrainvestor	8	(6%)	6	(75%)
Diskusjon.no	4	(3%)	4	(100%)
Trondheim Tech Startups (Facebook group)	11	(8%)	9	(82%)
Aksjeforum (Facebook group)	53	(37%)	30	(57%)
Total	142	(100%)	105	(74%)

4.2.4 Open Sources

We collected information from public bodies through open sources. We mostly obtained the information through the respective departments websites. The reason for this was that most information was publicly available, and that several thorough reports had already been produced

on both blockchain and on an electronic shareholder register. This made the information easily accessible for us, and it answered most of the questions we had. We assessed that there would not be much value in collecting additional information through other methods. Open sources were used on the governmental actors such as the Norwegian Tax Administration, Ministry of Finance, Ministry of Trade, Industry and Fisheries, and in addition, it was used on all other relevant companies, such as competitors.

4.3 Quality of Research

Qualitative research, and especially case studies, are often criticized for the lack of a transparent method and analysis process, and lack of generalization power of the theories developed. To address this, and to achieve a high overall research quality, we have judged our research design according to its validity and reliability. For this process we have used three specific criteria for this process proposed by Yin (2003), as explained in the sections below: construct validity, external validity and reliability.

4.3.1 Validity

Construct Validity

The construct validity of a study concerns establishing correct operational measures for the concepts being studied (Yin, 2003). To deal with this concern our research has taken primarily three measures, all of them recommended by Yin. First, we used *multiple sources of evidence*, which allows observations to be strengthened when done from several sources, but also to discover possible errors or disputes if multiple sources suddenly contradict each other. We also combine using qualitative methods with quantitative methods in our data collection, something Cooper et al. (2006) refers to as *triangulation*. We conducted the qualitative and quantitative studies simultaneously, but if the quantitative study was delayed following the qualitative study, it would possibly have provided an even stronger validation.

A second measure taken in our research was to first do a thorough job of creating a theoretical framework, going through most of all relevant literature on our topic (see section 4.2), which we then used to map operational measures of interest into to questions for data collection. This process created a *chain of evidence*. Thirdly, Yin (2003) recommends that one can first create a draft case study and allow it to be reviewed by key informants. We did this through a meeting and presentation with employees of Blockchangers of our draft and temporary findings in February 2018 (see all meetings in Appendix B), where we discussed our construct validation. Ideally this could have been followed up by another meeting even later in the process, and also have been

done with key informants less involved in the case study itself.

External Validity

The external validity of a study concerns the problem of establishing the domain to which a study's findings can be generalized, if it is possible to generalize from at all (Yin, 2003). In our research we have only used one single case study, and the external validity of our research would clearly have been strengthened if we were to replicate our findings with other case studies. This would have made our overall research validity and quality more robust. However, as our research objective was not to make any conclusions about our case study's industry, the case study's chance of success, market value or similar, but rather to test our quite abstract theoretical framework in real-world application, we believe that even only one case study gives sufficient reliability.

4.3.2 Reliability

Research is said to be reliable if it supplies consistent results, or for a single study: if it proves its operations, e.g. the data collection procedures, in such a manner that it can be repeated with the same results (Yin, 2003). Reliability is a necessary contributor to validity but not itself a sufficient condition for validity (Cooper et al., 2006). To illustrate this point, imagine a researcher that always gets something wrong, but consistently so, with always the same wrong result. Then this researcher conducts reliable research but not valid research. However, if a study is not valid it hardly matters if it is reliable or not, and therefore validity is most important. However, according to Cooper et al., reliability is often easier to assess.

An example of reliability concerns in our research has been that of interviews. Semi- or non-structured interviews are to a significant degree influenced by subjective interviewing skills and cognitive limitations. Also, information collected through interviews can potentially be colored by the views of the respective interviewee. As a result, there is a low possibility of receiving consistent information and results across several interviews or if one were to repeat the interview at another time with another interviewer. Thus, the reliability of information from interviews is low. However, through triangulation, i.e. using multiple sources, and conducting many interviews, this concern can be mitigated. The former has been addressed above in section 4.3.1, and the latter helps as it allows to cross-validate before any conclusions are made (Yin, 2003).

Unfortunately, interviews take a lot of time, and our research was limited by this. However, we took some additional measures such as to prepare all communication with our interviewees both before and during interviews in advance, to make sure it was perceived as neutral. Also, we did background research on every interviewee to find in advance which views we would

expect or already could know that he or she had. Hence, we had a chance to recognize if some interviewee changed view on some topic during the interview.

Survey Responses

Cooper et al. (2006, p. 300) describe in a set of different factors that can affect respondents' honesty when answering questionnaires and surveys. One syndrome named *peacocking* is when respondents exaggerate to be perceived as smarter or richer than they are. This can significantly decrease the reliability of survey results. We feared this effect in particular for questions that ask for the respondent's income, net worth and other questions related to the respondent's wealth. One way of preventing this is to incentivize honesty, or at least to not incentivize any exaggerations, by giving complete anonymity. However, if e.g. an individual knows that data will be aggregated for his or her "tribe" (industry, education level, geographic group, etc.), he or she might still desire to exaggerate to affect this result. Because of this, we decided to not include any questions of group identity other than a bare minimum (sex, age, and job situation).

A second factor described by Cooper et al. (2006), which they call *pleasing*, is when respondents give the answers they think the researchers want to receive. We did several things to prevent this: First, we shared our survey only in groups which none of us researchers had any relations to, and in which we did not expect anybody to be acquainted with us. Second, we did not mention or disclose any information about our case study, as this could have been perceived as a commercial interest and therefore a certain desired result of the survey. Third, we did not mention blockchain technology or anything that would imply the use of this technology, as we suspected this to be a topic that some respondents could have a predetermined opinion about (either positive or negative).

Table 4.2 shows the distribution of our survey responses from different forums. It shows that a large group of the answers came from an open Facebook group, one with many users, and one that probably is diluted with small-scale investors not making a serious effort with their investing. The low rate of respondents from this group that answered enough of our responses to be considered in our analysis (57%), the lowest of all the forums we shared our survey in, could be a result of this. We did not desire any responses of such people as we did not consider them part of our stakeholder group of interest, and, secondly, because we assumed their responses to be of lower quality and less reliable. By creating a quite long survey, consisting of up to 26 questions dependent on what one answered, and with few simple yes- or no-questions, our aim was to sift out unserious respondents before they finished the survey. It is hard to assess if this was a success, but the significantly lower rate of completing more than 10 questions in this Facebook group might be a sign it was.

A limitation of our survey that have prevented us from utilizing some of the data fully, is that

we mostly used intervals and multiple choice instead of asking for specific sums. The reasoning behind this was that such questions are easier to understand for the respondents, demand less of a detailed knowledge level among respondents, and might be perceived as less intrusive when it comes to sensitive information. Because of this survey design choice, we have difficulties with finding average values and to compare the relationships between a single respondent's answers on two questions (using intervals of e.g. 50-100 NOK and 100-200 NOK, this could mean a relationship of anything between 100% and 400%).

Personal Bias of Researchers

When conducting research, and in particular in small, homogeneous teams, personal bias is always a challenge. To ensure a minimization of bias and maximization of a study's reliability, Kothari (2004, p. 31-54) recommends following a rigid research design, with precise procedures and a minimum of flexibility. In our study, bias could among other things have had an effect during the development of our framework, e.g. through focusing on theory areas that we understood well or could relate to our case study (which we by then already knew about), and in interviews with experts and stakeholders.

To prevent unconscious selection bias when developing our framework, we purposely started out broadly, with all the three of us researchers suggesting all theory, previous frameworks for inspiration, topics, and possible focus areas for our framework we could come up with, before we together filtered out the majority of the suggestions. This process reduced the chance that we would overlook something compared to if we had simply decided to find e.g. four good topics and then finish the search process.

To reduce the influence of personal biases on our data gathering through interviews, we used semi-structured interview guides. Also, usually only two of us researchers took part in the interviews, while the third person listened to recordings afterward and compared the recording to our notes and conclusions based on the interviews. This gave us a second opinion on our findings less influenced by the atmosphere during the interviews, body language, personal relations, etc. Rigid rules such as these have increased the reliability of our research process.

4.4 Ethical Considerations

The goal of discussing ethical considerations in our research is to ensure that we have reflected upon and done our best to make sure no one has nor will be harmed because of our research. Cooper et al. (2006, p. 28) mentions several examples of unethical research activities, including: violating of nondisclosure agreements (NDAs), breaking participants' confidentiality, misrepresenting results, deceiving people, and more.

In our research, we have taken care to separate our research from that of our case study, despite communicating closely with them. To ensure our neutrality, and that we have been perceived as neutral, it has been important for us to inform our interview object and others that we have no interests in the success of our case study, and nor will benefit or gain from it any way. In our case, we had signed a contract between NTNU, us and our case study company before our work started that disallowed any re-numeration.

In all our interviews we have started the conversation by introducing ourselves, our research, our case study, and our objectives with the research. Thereafter, we have asked for the consent of the interviewees to take part in our research, and to be mentioned in our list of interviewees. In most cases we also have asked permission to record the interviews, and in all cases, we have made clear that nothing will be quoted from the interviews with non-anonymity unless we specifically ask permission for every single quote first. Despite having interviewed quite few people, our purpose has been that no information from our data collection should be able to identify which of our interviewees it came from, unless permission was given as described above.

What regards confidentiality around our case study, we signed an NDA with Blockchangers AS after our second meeting with them, and before they shared any non-public information with us. Also, as part of our master thesis contract with NTNU and Blockchangers AS, it was decided that the publication of our research should be postponed by three years to protect the ideas and intellectual property of Blockchangers. In this period, the research is only available to the researchers, Blockchangers, and NTNU for revision.

Part II

Application of Framework

Chapter 5

Business Idea

In this second part of our thesis, we apply our framework on Startblock, our case study. We follow the steps of the framework chronologically by first digging into and getting an overview of the business idea and stakeholder ecosystem in this chapter, before we in the next chapters analyze what this means for their platform and blockchain architecture. In the last chapter of this part, we propose a solution architecture which includes products and services, revenue model, and governance structure.

5.1 Value Proposition

The first part of the framework is the business idea of the platform. We presented the business idea and value proposition of Startblock in section 2.1.2. In short, Startblock is a blockchain-based platform for trade of shares and shareholder administration. The platform has three main functions: an automated capitalization table for companies, a marketplace for shares in companies registered on the platform, and a portfolio of shares for investors. Startblock may be further expanded in the future, for example by making it available through an API or adding new services. This should be taken into consideration when designing the blockchain architecture.

5.2 Stakeholder Ecosystem

Next we map the stakeholder ecosystem. As described in 4, we identified the different stakeholders through interviews with Blockchangers and by an analysis of the business idea. Our approach was simple. We first mapped the current ecosystem in collaboration with Blockchangers, we then saw whom Blockchangers wanted to introduce services to, and which stakeholders were associated with these services. This was important as the new services could make some changes to the current stakeholder ecosystem. Finally, through Blockchangers business idea we

saw that the shareholders could be split into sub-groups as some of the services of the platform were targeted at specific shareholder-groups.

5.2.1 The Ecosystem as a Whole

The current ecosystem for share issuing and trade of shares, and communication with government bodies is shown in figure 5.1. In this ecosystem, the three main actors are shareholders, private limited companies, and banks. They interact as shareholders buy and sell shares either from private limited companies or from other shareholders. The banks provide banking services to both companies and shareholders, and only facilitate interaction between shareholders and companies through payment services. The other stakeholders are public bodies. The companies need to comply with regulatory requirements, and especially notable is the shareholder register statement to the Norwegian Tax Administration. The shareholders also interact with the tax administration through their tax-report.

By introducing the Startblock platform, the ecosystem changes. As seen in figure 5.2, not many new stakeholders are added, but their interactions change as the platform becomes the center for most interaction between the stakeholders. The platform itself facilitates direct interaction between shareholders and private companies. However, we have in addition to these identified other stakeholders which have an interest in the platform, such as public bodies, banks and competitors. In addition, other companies offering similar services or companies interested in the data or users of the platform are also stakeholders. In the following subsections we present the stakeholders in more detail.

The most fundamental stakeholders on the platform are the shareholders and the companies. These stakeholders create value through direct interaction with each other, and this interaction is at the core of the ecosystem. The rest of the shareholders in the ecosystem receive their value from this interaction, either as enablers of or regulators of the activity.

The enablers, such as banks and Startblock, are facilitators from the direct interaction between shareholders and companies. They not only provide value by facilitating the interaction, but also gain value from the interaction. For these enablers, it is important to both understand what their motivations are and how they provide value, as this has an impact on their incentives for participating, and therefore the pricing model.

For the regulators, we can divide them further into two groups. The first group are those who regulate each individual stakeholder, such as the Norwegian tax administration, who regulate shareholders. Regulations from this group are requirements for the shareholders, and Startblock can create added value for the affected shareholders by offering a solution that answer to

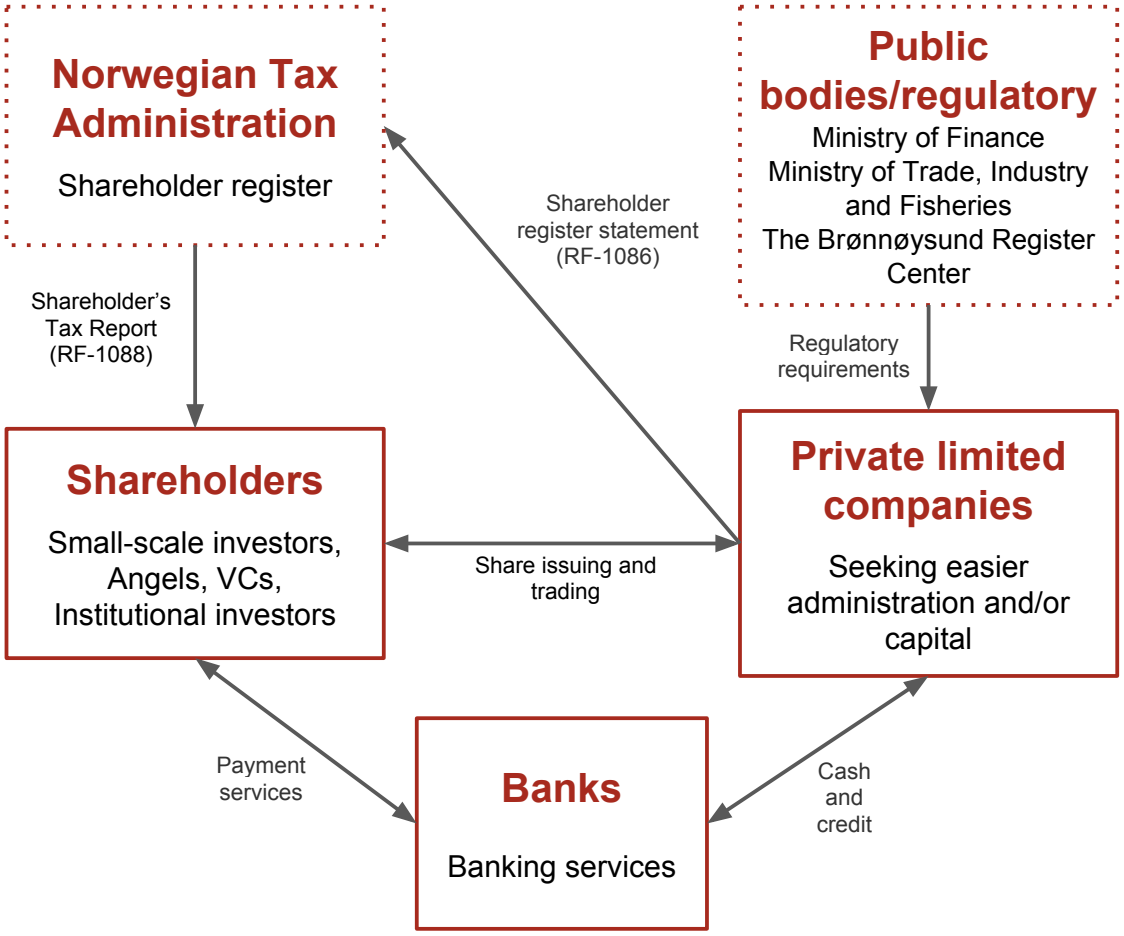


Figure 5.1: Overview of stakeholders today

these requirements. In this way, Startblock is valuable for both the regulator and those regulated.

The second group of regulators are those who regulate the interaction between stakeholders in the ecosystem. An example of this is the Ministry of Finance which has requirements on how shares are traded. The requirements from this group are the most important requirements. Without complying with these, there can be no (legal) interaction, and no value creation.

5.2.2 Public Bodies and Regulators

The Ministry of Finance

According to a proposal from the Norwegian Ministry of Finance (2017), if Norway is to be able to continue its high level of welfare in the coming years, it is dependent on making it profitable to start and develop new businesses. Therefore, they write, the government should give more incentives to entrepreneurs who want to establish new companies, and support initiatives that

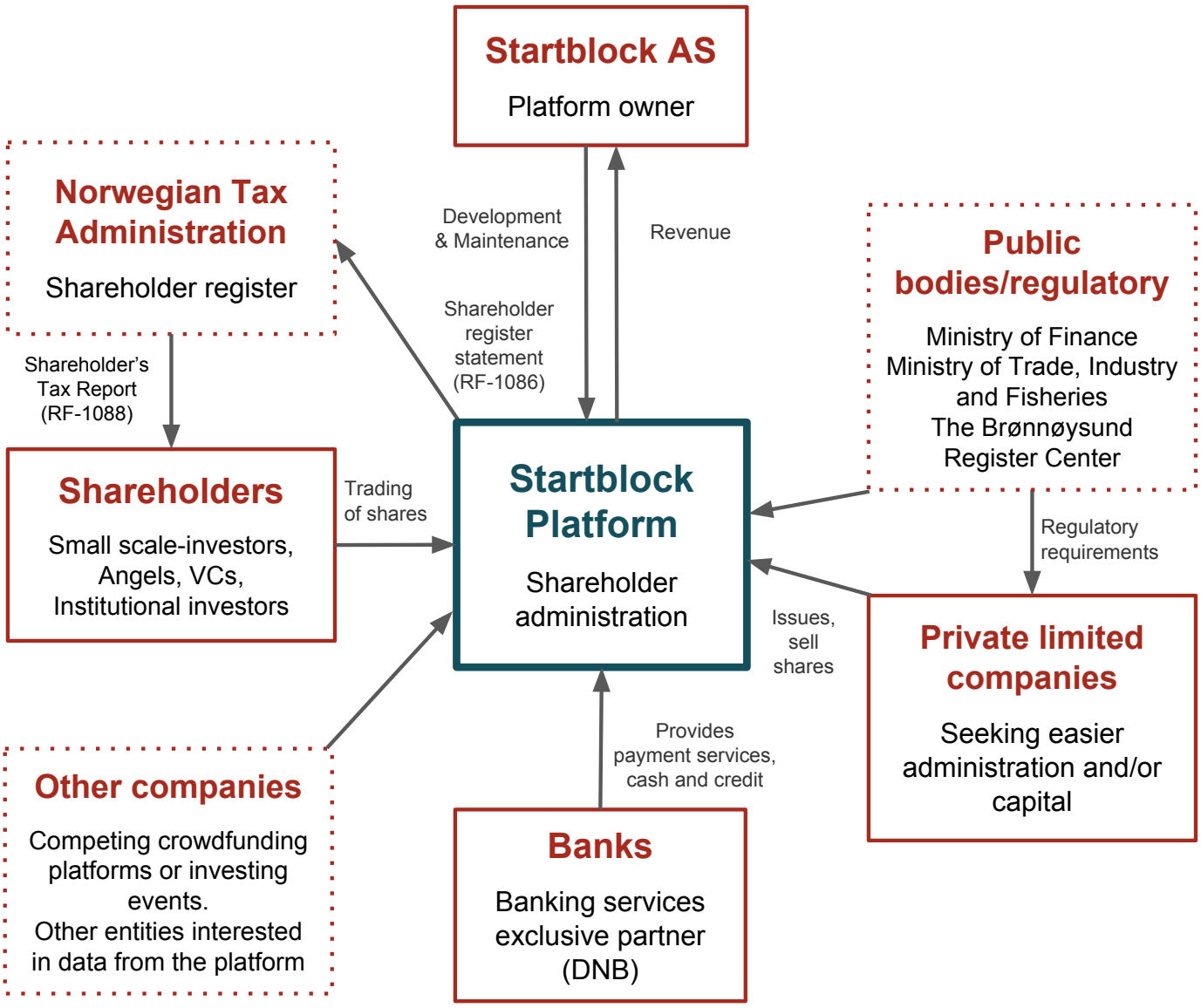


Figure 5.2: Overview of stakeholders after introduction of Startblock

help them achieving this. This is why the Ministry of Finance in 2017 introduced the tax incentive scheme described in section 2.4.

The Financial Supervisory Authority of Norway

The Financial Supervisory Authority of Norway (Norwegian: Finanstilsynet) is supervised by the Norwegian Ministry of Finance, and this is an independent government agency responsible for supervision of financial companies in Norway according to laws and regulations from the Norwegian Parliament, the Government and the Ministry of Finance itself. They are responsible for the supervision of, among other actors, stock exchanges and authorized marketplaces, investment firms, settlement centers and securities registers (Finanstilsynet, 2017). Consequently, an exchange for unlisted stocks would be of great interest for these authorities.

The Brønnøysund Register Centre

The Brønnøysund Register Centre (Norwegian: Brønnøysundregistrene) is a government agency subordinate to the Norwegian Ministry of Trade and Industry. They are responsible for the management of numerous public registers for Norway, and governmental systems for digital exchange of information, among them *Altinn*. In 2014 they published a report ordered by the ministry about how to create a public electronic shareholder register, to be established in 2015 (see section 2.3). If this register will come into existence, or if Startblock would like to connect to Altinn, the Brønnøysund Register Centre will be an important stakeholder for them.

5.2.3 The Norwegian Tax Administration

The Norwegian Tax Administration (Norwegian: Skatteetaten) is another government agency subordinate to the Ministry of Finance, , in figure 5.2 placed by its own because of its important role, responsible for resident registration and tax collection in Norway (The Norwegian Tax Administration, 2018). Every year, all private limited companies in Norway are required to deliver an updated shareholder register statement ("Aksjonærregisteroppgaven RF-1086") to the Norwegian Tax Administration. The purpose is to give the government an overview of who has ownership of what for taxation purposes. The register from the companies gives the Tax Administration a foundation to produce and distribute the shareholder's tax report ("Aksjeoppgaven RF-1088") to all the companies' shareholders, which the shareholders then use to declare their assets (Altinn, 2017).

5.2.4 DNB

DNB is Norway's largest financial services group, where they have wide distribution power, one of the largest in the Nordics. They have more than 2 million customers and offer loans, savings, advisory services, insurance and pension products for retail customers and businesses. DNB's profits in 2017 was in excess of 20 billion NOK. The largest shareholder is the Norwegian Government through the Ministry of Trade, Industry and Fisheries with an ownership of around 1/3 of the group. According to DNB, as part of their strategy in the period ahead, their total digital competence and innovative power will be increasingly important competitive advantages (DNB, 2018).

DNB is one of the new stakeholders to the ecosystem introduced with the Startblock platform. On the platform they could provide financial services to stakeholders such as payment services (escrow services), cash/credit to shareholders and private limited companies, and perhaps also loan financing and more.

5.2.5 Private Limited Companies

Private limited companies are not registered on a stock exchange, and often also not registered with the Norwegian *Central Securities Depository* (CSD). In these companies, shares are instead traded directly between shareholders. Companies may also raise capital by issuing new shares, which they sell to existing or new shareholders. Frequent changes in the ownership of shares could make it difficult for companies, especially smaller companies with less administrative functions, to keep track in their shareholder register of who owns which shares, something they are obliged by law to keep track of. Furthermore, all private limited companies have to deliver a shareholder register statement to the Norwegian Tax Administration annually. The updating of the shareholder register could pose particularly large problems for startups with many and changing shareholders, new equity funding rounds and possibly also equity crowdfunding, in which frequently large numbers of new shareholders are introduced.

5.2.6 The Central Securities Depository

The Central Securities Depository (CSD) in Norway (Norwegian: Verdipapirsentralen, VPS) is a private limited company that provides infrastructure and services for the settlement of transactions of securities and the registration of ownership rights over securities in Norway (Verdipapirsentralen, 2018). This allows brokers and financial companies to hold their securities at one location where they can be available for clearing and settlement. They offer registration for all the major types of financial instruments that are traded in Norway, namely shares, bonds, eq-

uity certificates, short-term bonds and funds.

Verdipapirsentralen is owned 100% by Oslo Børs VPS Holding ASA, of which the largest shareholder with 19.82% shares is DNB Livsforsikring ASA (Wikipedia, 2018). This way, DNB happens to be the largest shareholder in VPS. Because of this, DNB's interests in Startblock might be affected by whether or not they believe Startblock might cannibalize on the business of VPS or not.

5.2.7 Shareholders

Shareholders are investors who own shares. Shareholders are legal persons, and may be both human and non-human entities, such as individuals, companies, organizations and agencies. The business idea of the platform is to create value for investors in three ways. First, the platform functions as a marketplace where investors may buy and sell shares of companies registered on the platform. Second, the platform gives an overview of all shares the investors own, and makes it easier for them to report it to the Tax Authority. Third, investors may register to buy newly issued shares in companies seeking to raise capital.

In our study, we appreciate that investors are not a homogeneous group, and they all have different experience with investing, motivation to invest, and capital base. We therefore create subgroups of shareholders:

Small-scale Investors

In Norway, the term small-scale investor (Norwegian: småsparer) is used for people registered with their social security number in the Norwegian CSD and thus investing privately. As the name suggest, small-scale investors usually invest a small amount. According to AksjeNorge (2018b), there was 365 thousand Norwegians who owned stocks on the Oslo Stock Exchange by the end of 2017. The total value of these shares was NOK 100 billion, which gives NOK 276 000 per person. About 30% of the investors were women, but only about 20% of the share values were owned by women (AksjeNorge, 2018a).

Business Angel investors

A business angel investor is an individual, usually with a high wealth and/or income, who is investing in startups or entrepreneurial companies either professionally or on a hobby basis. Angel investors often invest in the early stages of startups to help them propel and get through the first difficult stages (Investopedia, a). In our research we do not use any criteria regarding number of investments or the net worth of the investor, but simply consider all investors who themselves consider themselves angel investors.

Table 5.1: Small-scale investors on Oslo Stock Exchange in 2017. Data from AksjeNorge (2018b)

Age	Savers		Value [MNOK]		Value/saver [NOK]
0-17	3 810	(1.0%)	214	(0.2%)	56 168
18-29	26 303	(7.2%)	1 603	(1.6%)	60 944
30-39	46 931	(12.9%)	5 942	(5.9%)	126 611
40-49	61 193	(16.8%)	14 076	(14.0%)	230 026
50-59	71 139	(19.5%)	22 716	(22.5%)	319 319
60-80	128 887	(35.3%)	46 723	(46.3%)	362 511
>80	26 774	(7.3%)	9 555	(9.5%)	356 876
Total	365 037	(100%)	100 829	(100%)	276 216

Venture Capitalists

A venture capitalist (VC) is an investor who, in a similar way as angel investors, provides capital to startups or small companies that wish to expand and need more financial equity (Investopedia, b). VCs usually invest through private limited companies and have such a high net worth that they can afford the high risk of losses. VC investments are often organized by VC firms which pool capital from different actors in venture funds in order to do several venture investments. A VC investment is usually larger and placed at a later stage compared to angel investments. In reward for the risk they take they might earn massive returns on their investment if the companies turn out successful.

5.3 Survey of Small-Scale Investors

5.3.1 Stakeholder Details

The small-scale investors who answered our survey is a quite diverse group, except from when it comes to their sex: a significant majority of them are male (94%). From all the various sources we received responses from there were minimum 80% male answers, and almost one hundred percent for the two sources that gave most responses: the open forums for stock investing on Shareville and Facebook. The respondent's age distribution is centered at the low end of the population. 41% of our respondents are between the age of 26 to 35 years old, and the most common occupation is as a full-time employee in the private sector. See more in figure 5.3 and 5.4. The significant percentage of young people and students (32%) probably influences our results as they tend to have lower income, less aggregated savings and therefore also lower opportunities to invest.

The respondents had varied gross incomes over the past year. 25% had less than 200 000 NOK. This could be assumed to make up most of the student group, which naturally does not have a high income. The largest income group earns between 400 000 to 600 000, which is around the Norwegian average salary, but the distribution between 200 000 to 800 000 is quite evenly distributed. A quarter of the respondents earned more than 800 000 NOK, and 10% more than one million NOK. Based on this, our respondents seem to have a quite average Norwegian income.

We also asked about respondents' amount of savings available for investments (specifically asking not to include one's primary residence). 80% answered that they have less than one million NOK, 36% have between 200 000 and 500 000 NOK, and 20% respondents have on less than 200 000 NOK to invest.

5.3.2 Stakeholder's Motivation

Most of the respondents already own shares in companies on the stock exchange. Only 15% do not own any shares, 35% own shares in 1-4 companies and 31% in 5-8. Only 12% own shares in more than 12 companies. The small-scale investors seem to be comfortable holding shares in a handful of companies, and with less than half a million NOK invested. 12% had invested less than 20 000 in total, 22% less than 50 000 NOK and 18% had invested between 50 000-100 000, and 36% had invested between 100 000 - 500 000. Only 17% had invested more than a million NOK.

The small-scale investors do not invest as much in startups as they do in companies on the stock exchange. 57% of the respondents have not invested in any startup company the last 10 years,

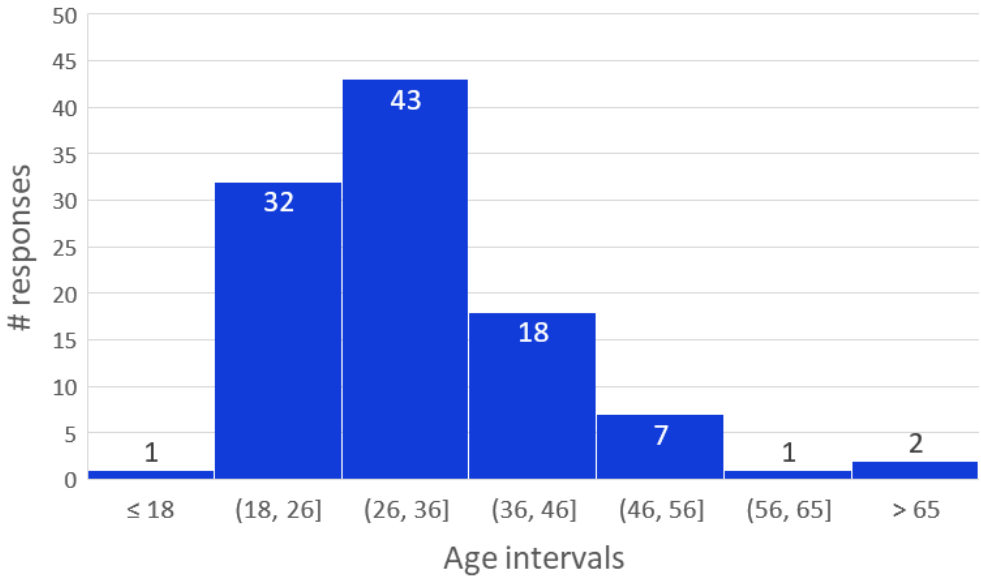


Figure 5.3: Age distribution of respondents (n=105)

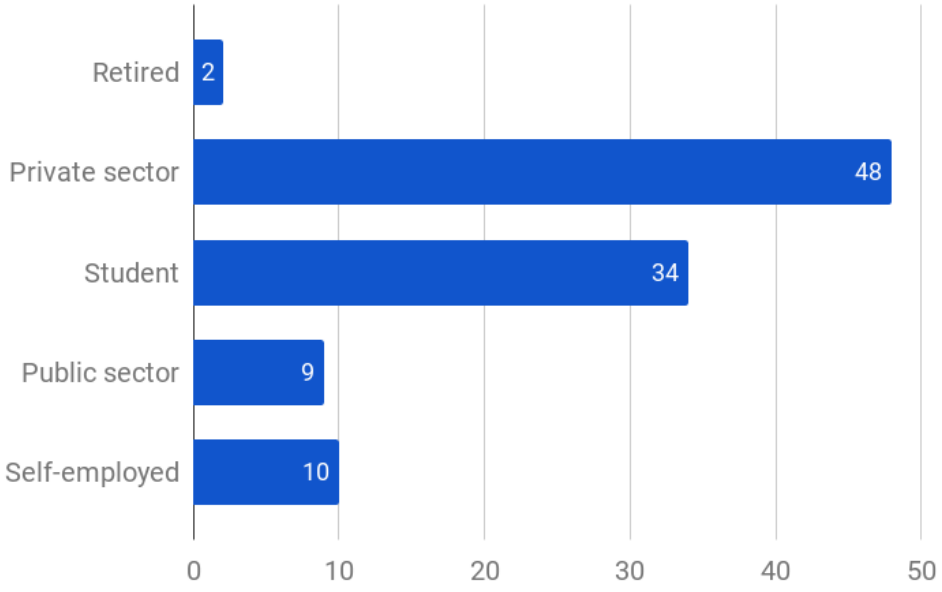


Figure 5.4: The occupations of our respondents (n=103)

while 31% own shares in 1-2 startup companies. Only 12% own shares in more than 2 startups. Further, among those who have invested in startups, the amount invested in each startup varied, but 76% invested less than 50 000 per startup, and 55% less than 20 000 NOK. Moreover, only 21% the respondents have participated in an equity crowdfunding the last 10 years, and only 6% have participated in more than two. Most of the former group, 57% of them, invested less than 5000 NOK per crowdfunding in average, a minority invested up to 10 000 or 20 000 NOK, and only two respondents answered that they had invested above 50 000 and 100 000 NOK respectively (both in 1-2 crowdfundings).

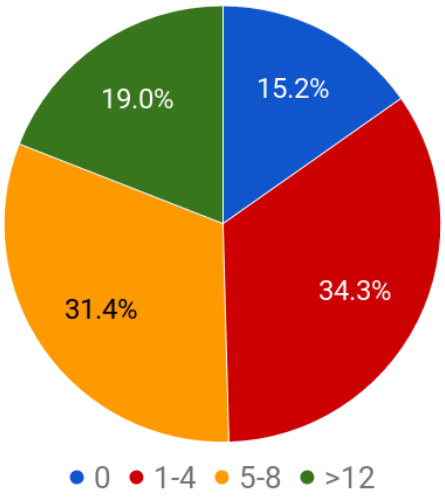


Figure 5.5: "In how many listed companies do you own stocks?" (n=105)

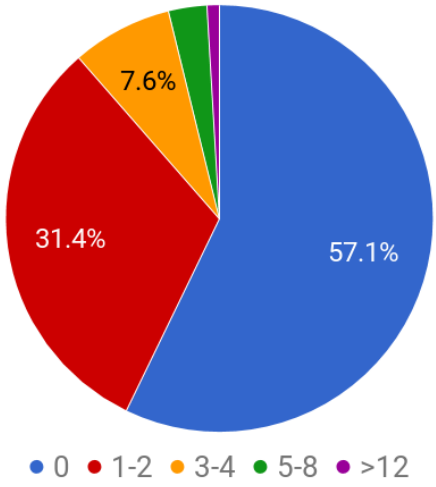


Figure 5.6: "In how many startups have you invested the last 10 years?" (n=105)

It is clear that small-scale investors are less likely to invest in startups than on the stock exchange. However, the respondents were positive towards a platform to invest in startups. When asked how likely it would be that the respondent would have started using a digital platform that simplified finding and investing in unlisted companies and startups, 81% said that this is either quite likely or very likely (54% and 27% respectively). Only 10% answered that it would be quite unlikely or very unlikely. In total, more than 48% of the those that said this was likely (n=88, of 105 originally) estimated that they would have invested up to 50 000 NOK on such a platform. 25% would invest between 50 and 100 000 NOK. This shows that the respondents would buy more shares in startups if they had the opportunity to do so, indicating that it is not the motivation that holds them back.

In their answers on how much the respondents would have invested in average per company on the described digital platform, 33% answered that they would have invested less than 10 000 NOK, 33% that they would have invested 10 000 to 20 000 NOK, and the last third would have

invested more than this. Of the last third, almost two thirds would have invested up to 50 000 NOK in average. Only four respondents answered that they would have invested more than 250 000 NOK per company, one of them even more than 500 000 NOK. Out of these four individuals, three answered that they have more than 5 MNOK worth of savings available for investments, the remaining one 1-5 MNOK.

5.3.3 View on Other Platform Stakeholders

On the platform, respondents indicated that they would spread their investments on several startups. 25% of the investors interested in the platform n=88) say they would have liked to invest in 1-2 companies, 49% in 3-4 companies, 10% in 5-8 companies and 14% in more than 8 companies. From these numbers we observe that the small-scale investors surveyed want to invest in a similarly high number of startups/unlisted companies as they already have invested in listed companies (on an exchange), although with a significantly lower amount. In fact, 34% of the respondents answer with a higher maximum number of startups they would like to invest in through the platform than the number of listed companies they already own shares in themselves.

A couple of likely reasons for the phenomenon described above are that: first, small-scale investors perceive startups as more risky investments and therefore would like to distribute their investments more. Second, many of our respondents are young and not yet full-time employed, and therefore they might have reasonable expectations to invest both more and in more companies in the future than they currently have. Other possible reasons regarding the reliability of our respondents' answers are discussed in section 4.3.2. In any case, the low expected investments per company implicate that a company with large stock values available on the platform would need a very high number of investors, if these small-scale investors will be the only type of investors on the platform.

Another finding related to how much the respondents consider it likely that they would invest in startups and other unlisted stocks through the platform, is that most respondents give significantly lower estimates that they currently have invested in listed stocks. Considering the risk of ownership in small companies mentioned above, and that the platform described in the survey is presented as something new (as opposed to the currently established exchanges), this was as expected. Figure 5.7 shows a histogram that illustrates the distribution of this relationship for respondents. Some of the responses illustrated in the rightmost bin were in the range of 200-500%.

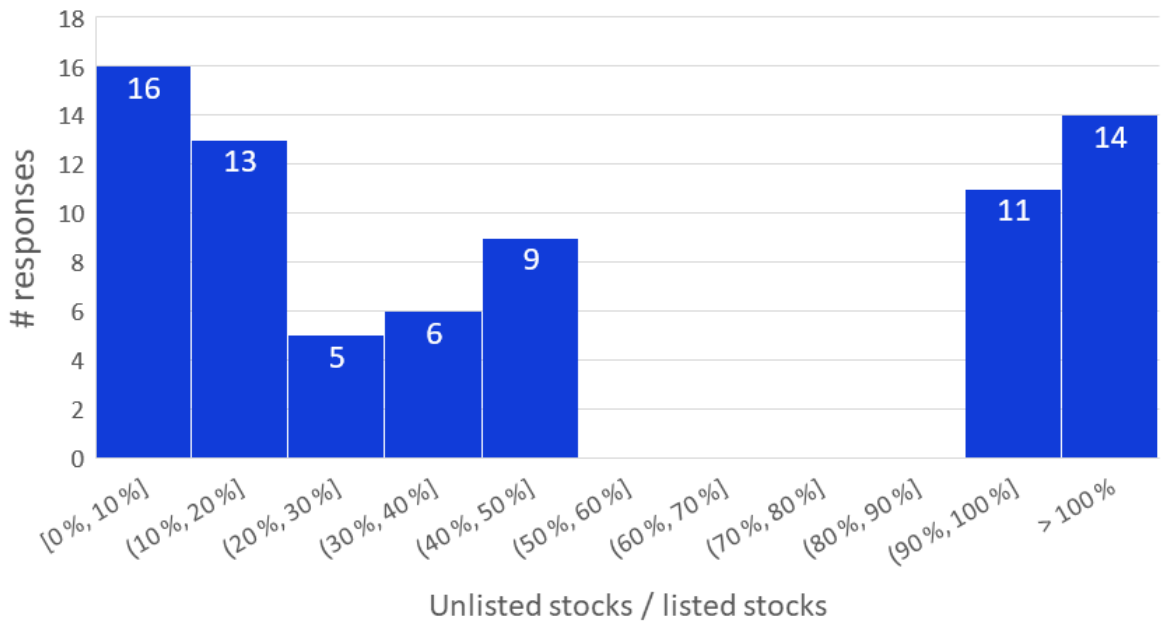


Figure 5.7: Desired amount invested in unlisted stocks on platform divided by amount currently invested in listed stocks on stock exchanges (n=74)

5.3.4 Value from the Business Model

The small-scale investors are interested in a market for unlisted shares, but see less value from the Tax Incentive Scheme. A large majority of the respondents answered that they have little or no knowledge about the new Tax Incentive Scheme in Norway. 57% answered that they "to a very little degree" know about it and 20% "to a small degree" know (n=105). Only four respondents answered that they know it very well.

Despite the low knowledge of the Tax Incentive Scheme, 28% of the respondents answered that they consider it likely that they will invest more in startups in the future because of this incentive. This is approximately as large a share of the respondents as that which knows about the scheme. However, an interesting finding is that 22 out of 29 (76%), who answered that they consider it quite or very likely that they will invest more because of the tax incentive also answered that they have little or no knowledge of it. Moreover, 10 out of 22 investors (45%) that said they know the scheme well also said that it is unlikely that they will invest more because of it.

This finding might indicate an immediate naive optimism about the scheme among those investors who did not know about the Tax Incentive Scheme, and a lack of knowledge of the several restrictions to it. Those who did know about it, on the other hand, mostly respondents at higher ages and few students, might either not care much about the opportunity of some tax deduction, or just do not bother because of the restrictions the scheme has. 43% of the respondents

answered, "I don't know" on this question. Also, 74% answered that they would be interested in a platform where they could easier make use of the tax incentive scheme (and 73% if one only considers those who actually answered that they know the tax incentive scheme well).

What regards the payment model of the platform when it comes to buying and selling of shares, the respondents answered that they favor two solutions: a fixed fee or percentage fee per transaction. See the detailed results for which payment models they prefer in figure 5.8. In figure 5.9 and 5.10 we illustrate our respondents' views on how much they would be willing to pay in fees as fixed fees per transaction and as a percentage of the transactions, respectively. As a reference, the brokerage fee on Nordnet for their most popular investor subscriptions are 0.049% with a minimum fee of 79 NOK, or 0.15% with a minimum fee of 29 NOK (Nordnet, 2018). Their minimum fees are comparable to our results for fixed fees, whereas our respondents show a willingness to pay a much higher percentage fee.

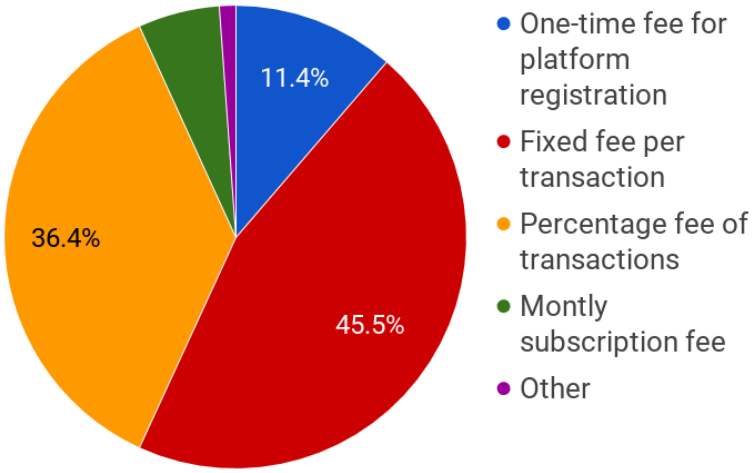


Figure 5.8: "Which payment model would you prefer?", for the Startblock Marketplace (n=88).

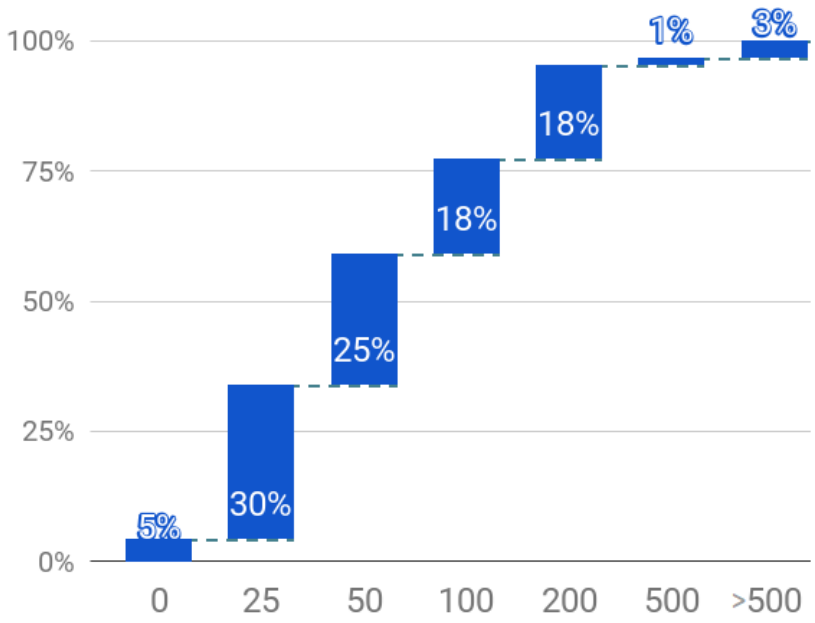


Figure 5.9: "Up to how much would you be willing to pay in fixed fee per transaction?". In NOK (n=88).

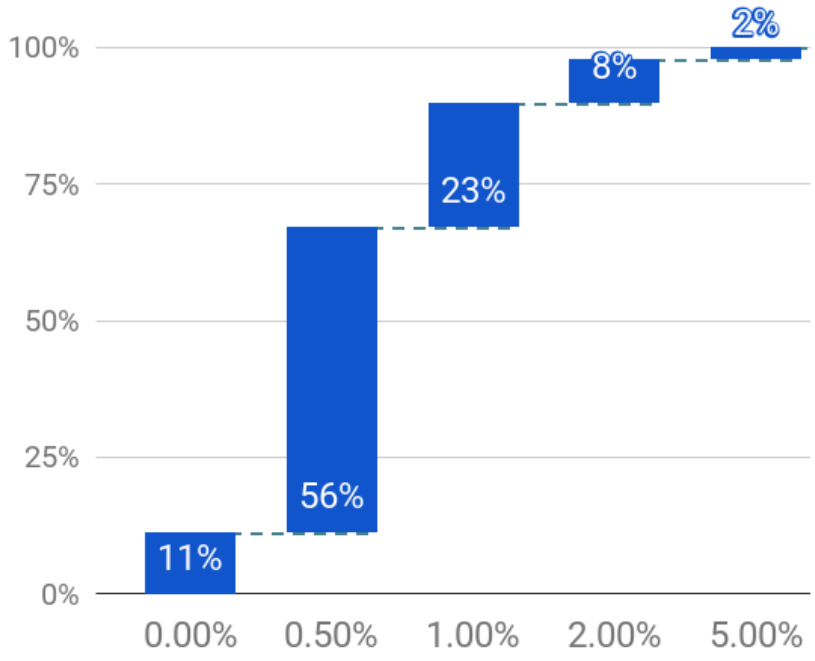


Figure 5.10: "Up to how much would you be willing to pay in fee per transaction?" In percentage of transaction value (n=88).

5.4 Interviews with Angel Investors

See Appendix C for the interview guide used for our semi-structured interviews.

5.4.1 Stakeholder Details

All the five angel investors interviewed were men between 35 to 55 years old. The angel investors had between 1-5 years experience with angel investments and had each invested between 400 000 NOK to 50 million NOK in total in startup companies. The interviewed angel investors broadly agreed on the topics we discussed. However, we saw a tendency that the more experienced investors had not only invested in more companies, but also both more money invested per company and a longer horizon on their investments. Newer angel investors had an expectancy of 1-4 years, while the most experienced had around 10 years.

5.4.2 Stakeholder's Motivation

The angel investors interviewed all communicated an interest in contributing to startups with more than money, also giving them advice and being involved in decision-making. Thus, they are more involved in the business than ordinary investors. Several of the angel investors interviewed had themselves been involved in startups previously, and were interested in both the startup life and the technology startups developed. A common denominator for those interviewed was that they want to know the team behind startups well before they invest. Apparently it is more important for them to believe in the team than the product itself.

The more experienced angel investors interviewed are usually introduced to startups either through other investors or by startups directly approaching them. Some of these said that they invest in maybe one out of ten startups they assess. Given this, they did not themselves have a need for a platform to find even more startups to meet with, but they appreciated that some startups could need something like this to be discovered. As one investor put it, the most promising projects and teams always find funding. A platform for investing in startups would therefore according to the view of several angel investors be more interesting for the mediocre startups. This is arguably the situation already today.

The less experienced of the angel investors interviewed said that they mostly got in touch with startups through investor events, such as DNB Next Startupmatcher, but also that they believed only the mediocre investment opportunities were left to participate in such events. If a new platform was to be used by most startups, not just those who fail when approaching the well-known angel investors, this would thus allow more equal opportunities to all angel investors.

5.4.3 View on Other Platform Stakeholders

Angel investors see it as a disadvantage if startups have many shareholders, and they are especially negative towards crowdfunding of equity. There are several reasons for this. The main reason is that it creates a messy capitalization table, which in turn makes venture capitalists skeptical. Angel investors and VCs know that it might be an administrative burden to have many small investors, and fear that these do not have the same long-term interests as they do. Many equity owners mean it is harder to agree on the direction of the company. Further, and even more important, they fear that an early crowdfunding can dilute the startup founders' ownership of the company at a too early stage, which can either indicate or lead to a situation in which the startup team does not have enough ownership nor motivation to succeed, a red flag for many professional investors. Lastly, according to our interviewees, many and large shareholders not involved in the company is undesirable in phases of growth.

Experienced angel investors had a long-term perspective for their startup investments. To make companies develop, they do not want much trading of the shares, as this could mean that the founders or other investors could pull out. They see it as an advantage for the company if other investors do not pull out at all, as this creates unnecessary noise. Too much liquidity in the shares may also attract short-term investors and make the company loose track of the long-term goals. In general, the angel investors see it as an advantage if all investors stay involved in the company, and that trading is prevented. According to them, the statutes of startups and shareholders' agreements also often prevent the trading of shares, at least for some specified period of time, or give existing investors priority (first refusal) for buying any shares put up for sale.

Several angel investors see it as more beneficial if there is a syndication of the crowdfunded equity investment. With one person/company per syndicate instead of many, and presumably somebody more knowledgeable about being an investor, this would make communication with shareholders easier and demand less time from the startups spent on managing shareholder relations. As mentioned above, the angel investors also see this as important conditions if a startups aims to attract venture capitalists at a later stage. Syndication of investments is already often done by angel investors in Norway, through the formation of angel groups, according to our interviewees.

5.4.4 Value from the Business Model

One of the value propositions on Startblock is to provide investors a way to manage their portfolios, however the angel investors mostly use spreadsheets to manage their investments. They keep their investments for many years and rarely do any changes. They therefore do not see any need for a more advanced solution, such as an automated portfolio. Especially not if the portfolio would only involve companies listed on the Startblock platform.

The angel investors believe it is good for startups to have experienced angel investors investing in their company. Investing in a startup means that one vouches for the team, which – in the case of acknowledged investors – can attract even more other investors. Some investors said that they often invest after someone else has pre-qualified the company by agreeing to invest, as this makes it easier to filter out only the good teams.

The possibility of doing an electronic general assembly is very well received by some angels. At the time of the interviews, the angel investors said they usually send an authorization to the chairman before general assemblies, and do not take part themselves. Any solution that makes signing papers and voting in the general assembly without having to physically take part themselves would be highly regarded. The experienced angel investors believe the platform should have some sort of integration or possibility for moving the company shares to the Norwegian Central Securities Depository (VPS), as in the long term, many companies should aim to be listed on the VPS. However, they emphasize that the most successful startups do not need to be registered on the VPS.

Several of the angel investors said that the tax incentive scheme has a negligible effect for them, because of its several restrictions. Most of them consider it positive that the government give incentives, but for many of them the tax return is so small that it does not change anything for their investments. Some of the angels said that they would have liked the incentives and amounts eligible for tax refunds to be increased to a level comparable with other European countries.

5.5 Interviews with Startups

5.5.1 Stakeholder Details

We interviewed five different startups, which in this setting was limited to companies that consider themselves startups. In all cases, except one, the CEO and co-founder of the company was the person interviewed. In the last case, it was a former CEO and co-founder that was interviewed. The startups interviewed are between 1 and 2 years old, and have between 4 and 13 employees. All the startups have initially offered consumer products or services, but some were considering to pivot to the business market. The startups have raised equity in different ways. Three of the companies have done an equity crowdfunding, one is in the process of preparing one, while the last one does not want to do crowdfunding.

The companies that have done an equity crowdfunding raised between 700 000 and 1.2 million NOK by this method. One of them has also raised 1.5 million NOK in a follow-up round, where half of the capital came from existing crowdfunding investors. The startup planning a crowdfunding has earlier already received a few million NOK in funding by a handful individuals, and is planning to raise around additional 3-4 million NOK in a crowdfunding campaign. The company who has not done an equity crowdfunding has raised around 2-4 million NOK in regular funding from around 10 angel investors.

5.5.2 Stakeholder's Motivation

All the startups interviewed were focused on developing their business and their products. They see their administrative tasks as time-consuming, and, although necessary, as a distraction from their main goals. Interestingly, even though they have used different methods to raise capital, they all used these funding rounds as a means to add additional value to the company beyond the funding itself.

The startups that have conducted, or planned to conduct, a crowdfunding, list several motivations for raising capital this way. First, they see it as a straightforward way to get investors and capital, as all of them used crowdfunding events or platforms that pair them with investors. Second, by doing a crowdfunding, the startups got many ambassadors for their product or service which could give them more publicity and marketing. A common trait of the startups wanting to do equity crowdfunding is that they offer consumer products or services, which they want to advertise to as many as possible. By doing a crowdfunding, the startups gained publicity both during the crowdfunding campaign, and later through all the investors, who by then had a stake and special interest in the company. Further, what characterized these startups is that they did not need to raise a lot of capital. The companies raised around 1 million NOK each which, al-

ternatively, could have been covered by one or two angel investors. Nevertheless, the startups were satisfied with their fundraising, and are generally positive to raising capital this way.

The one startup we interviewed that is not interested in doing crowdfunding, they mainly seek angel investors who can contribute to their business in some way. Some of their investors have knowledge on intellectual property, some can help them through networking, while other can give them advice on internationalization. This startup values active investors more than passive ones. They also try to limit the number of investors, for two reasons. First, the startup says they would rather have three good advice than thirty average advice. Second, they wish to be attractive to venture capitalists in the future. At the time of the interview they had around 15 investors, and had even with this number received comments that it could make some venture capitalists skeptical.

Due to the arguments presented so far, the startup not interested in crowdfunding is nevertheless positive to syndication of investments. They answered, as other interviewees, that syndicated investments would make it easier to communicate with shareholders. But they still feared that it would be challenging to have active angel investors at the same time as many small investors, and that such an investment would still make them less attractive to venture capitalists.

5.5.3 View on Other Platform Stakeholders

As we saw in the previous section, the startups have different motivations, and therefore also different views on the other platform stakeholders. One group seeks expertise, and is therefore positive to angel investors, but more reluctant to accept investment from small-scale investors. Conversely, the other group wants to create ties with their users by letting the users own a stake in the company, and thus sees small-scale investors as adding value to the business. For these startups, the expertise from angel investors are not as strong a motivation, and they might be able to get expert advice from other sources. For example, the startup that currently plans to do a crowdfunding has a lot of expertise on the board already, and is therefore mostly interested in the funds that angel investors can provide. Consequently, they do not have the same prioritization of active investors as the first group does.

5.5.4 Value from the Business Model

There are several of the proposed services from the Startblock platform that are of interest for the startups we interviewed. The first is regarding the crowdfunding process itself. Some of the startups see several areas of improvements in the crowdfunding process they have gone through on other platforms. They reported a lot of manual administrative work both before, during and after the crowdfunding. One example of this is that they had to make sure that every investor that participated, some of them with almost insignificant amounts, sign all documents and complete

their payments. This was tedious and time-consuming work. Also, the startups had to complete all required legal documents, issue share certificates and hold general assemblies. Although the startups do not feel that keeping track of the share register and shareholder information itself is difficult, the former processes have shown to cause problems when startups have numerous small investors. The startups we interviewed are therefore very positive towards a possibility of automating and digitizing the whole crowdfunding process, including the signing of documents and confirmation of payments, and an opportunity for electronic general assemblies.

Further, several of the startups see it as an advantage if the platform could make it easier to communicate with investors. With possibly several hundreds of investors, it is difficult to keep track of e-mail communication and to make sure that each investor is kept up to speed on the development of the company. They would be more open to using a platform if it had functionality that made shareholder communication easier. In general, all the startups we interviewed are positive to everything that can automate any administrative work, as time is often their most limited resource and as they prefer to spend it running the company.

The startups have different opinions on what the best pricing model on such a platform would be. Some believe it would be better to pay a monthly fee to use the platform. By already paying for the platform, they could then use all the services without any limitation as everything is included. However, other startups believe it would be more beneficial if the platform only took a percentage fee of the capital raised from successful crowdfunding campaigns, as this would reduce the risk of paying for something they do not manage to utilize.

5.6 Interview with DNB

5.6.1 Stakeholder Details

It is an intention in Startblock's business idea that Startblock is to be associated with a bank. Startblock is currently in dialogue with the Norwegian bank DNB (see description in section 5.2.4). We interviewed representatives from DNB to understand their role on the platform and their motivation to participate in the project.

5.6.2 Stakeholder's Motivation

The vision of Startblock and DNB is that Startblock will be an independent company, but partly owned or connected with DNB. The bank has two main motivations to join the project. First, they want to offer better services to their clients. The purpose of these services would not necessarily only be to create revenue, but could also be to make DNB's clients more satisfied with their services, and to help DNB retain loyal customers. Second, the platform may create separate revenue streams for DNB if they, for instance, offer their financial services on the platform. It is clear from the interview that the first motivation is the strongest of these.

DNB has both investors and startups as customers. They see that there are several administrative nuisances for startups, especially around the capitalization table. Solving some of these problems may attract more startups to become customers of DNB. Further, the platform may give more opportunities to invest for DNB's clients. It is part of DNB's strategy to be the connection point between startups and investors. They currently use the platform DNB NXT to achieve this, but they believe that they should also explore other solutions.

At a general level, DNB is making a strategic shift from only providing traditional financial services to also offer more financial technology or fin-tech solutions. In this shift, they do not want to develop everything themselves. As discussed in section 3.1.1 on business model innovation, it is not apparent from literature whether or not incumbent companies should embed new BMIs into their core business or to establish them separately. In the case of DNB, the platform would certainly benefit from getting access to DNB's assets, customers and capabilities. Simultaneously, however, DNB could run a PR-risk by being closely affiliated with a new and untested platform and technology, or similar, and conflicts could also arise if the platform were to disrupt some of DNB's services. Furthermore, as DNB pointed out in our interview, large enterprises often have long development times, which may be a barrier to innovation. Therefore, DNB said they are moving away from the practice that everything has to go through DNB's portal, and that they were looking into alternative distribution models. This is illustrated in the way DNB plans to work with Startblock.

In the traditional model, DNB would have provided system requirements, and Blockchangers would develop the platform. Now, they pursue what they call "co-innovation", where each party contributes with their strengths. Blockchangers deal with blockchain and development, while DNB provides business development, customers and investments. DNB does therefore not have any specific requirements to the blockchain part of the platform. Considerations around the architecture is handled by Blockchangers. However, the bank has some regulatory requirements. Among other, they demand that the Financial Supervisory Authority of Norway, "Finanstilsynet", must have access to the ledger to conduct inspection.

5.6.3 View on Other Stakeholders

As described above, DNB has both startups and investors as customers, and wants to offer services to these two groups. It is beneficial for DNB to retain and attract more customers to their financial services of both these groups. It is therefore favorable that these two groups use the platform, and that Startblock itself is successful. Nevertheless, it is important to underline that financial services are heavily regulated in Norway, and need to be compliant if placed under scrutiny. Meeting the requirements from regulators is therefore a priority to them, and trumps whatever value that could be gained from other stakeholders.

5.6.4 Value from the Business Model

DNB has not yet decided their role on the platform, but they have several hypotheses on how they can contribute to the platform. These hypotheses are still on the drawing board, and DNB could not provide us with details at this stage. However, some discussed viable solutions are:

- White-labeling (DNB could sell products and services from Startblock under DNB's brand)
- Integration with DNB's other systems
- DNB could offer traditional financial services on the platform, such as loans

Chapter 6

Platform Architecture

In the previous chapter, we learned about the motivations and requirements from the different stakeholders in the ecosystem of Startblock. In this chapter we address the interests of all of them together, and by using the framework we have investigated which opportunities and limitations there are for the platform architecture.

6.1 Network Effects

In this section we present several network effects that we have identified through our survey and interviews with stakeholders. The main network effects are between the stakeholders participating the most directly on the platform: Startups and investors. The first thing we noticed when interviewing the startup companies, as described in the previous chapter, is that one cannot consider startups a homogeneous group. The startups we talked to provided us with two different views on their company's stance on crowdfunding. One group was positive and the other reluctant. To better illustrate the network effects we have therefore divided the startups into two groups: Non-crowdfunding-motivated startups and crowdfunding-motivated startups.

The first group is not interested in crowdfunding. It is characterized by having growth ambitions, also international. They wish to gain external expertise, especially through investors. Next, they need a lot of money through fundraising, and expect to raise funds several times. Lastly, they wish to appear professional to institutional investors.

The second group sees crowdfunding as beneficial for the company. A strong trait of this group is that they do crowdfunding as a part of the marketing of the company. By having their users become investors, they both gain publicity and obtain ambassadors that strongly want their product or service to become a success, as they themselves have a stake in the company. Companies in this group typically offer consumer products or services. Also, in contrary to the first

group, they typically do not raise a lot of equity. Usually between 250 000 and 2.5 million NOK. They do not expect to need to raise more funds anytime soon; hence, they do the trade-off by seeking several small investors instead of professional or institutional investors. Further, they are not as dependent on attracting investors with strong competence. The founder of one of these startups explained in our interview that this was either because they have the expertise in-house, or because they do not need the typical angel investor competencies such as business development and internationalization.

Having split the startups into two groups, we get two different models of the network effects. Both models can be seen in figure 6.1. In the left-hand model we show startups not interested in crowdfunding. As explained in the previous chapter, crowdfunding gives unstructured capitalization tables, and can make both angel investors and venture capitalists skeptical. The presence of small-scale investors therefore has a negative network effect on all other stakeholders in the model, as visualized with the red arrows. Angel investors and startups both give positive cross-side network effects to each other. Startups seek angel investors, and having more angel investors to choose from is positive. In the same way, having many startups to choose from is positive for the angel investors. However, this network effect is weaker.

None of the angel investors we interviewed saw it as likely that they would use the platform to meet startups. The reason for this is that they prefer meeting the teams of startups in person, and they are often introduced to startups through their network or other meetups. Meeting new startups to invest in was not an issue for them. For angel investors, the platform would therefore be the place where they do the investment in the companies, not where they find them. Having several startups listed on the platform would therefore not make it more interesting for them to use the platform. However, all the angel investors were positive to electronic general elections and an easier way to communicate with startups. In this way, the platform solves some problems for angel investors, and the more startups that use the platform, the greater the likelihood that some of their investments are on the platform. The benefits from the platform are tied to each individual investment, and the value is therefore stacked. The angel investors therefore have a positive network effect from startups. Further, there is also a positive network effect between the angel investors. As angel investors explained to us, they often use each other's investment as a sign that the startup has a strong potential.

In the right side model, we have the startups positive to crowdfunding. Contrary to the left model, the small-scale investors here have a positive cross-side network effect with the startups, as the startups see the small-scale investors as desired investors. Except from this, the models are similar. It is worth noticing in the right model that although startups are positive to small-scale investors, the negative network effects from small-scale investors to VCs and angel investors persist. Further, a more nuanced model would have indicated a weaker positive

network effect from angel investors to startups in the right model than in the left model, as the crowdfunding-motivated startups are less interested in the angel investors than the other startup group (they have more alternatives).

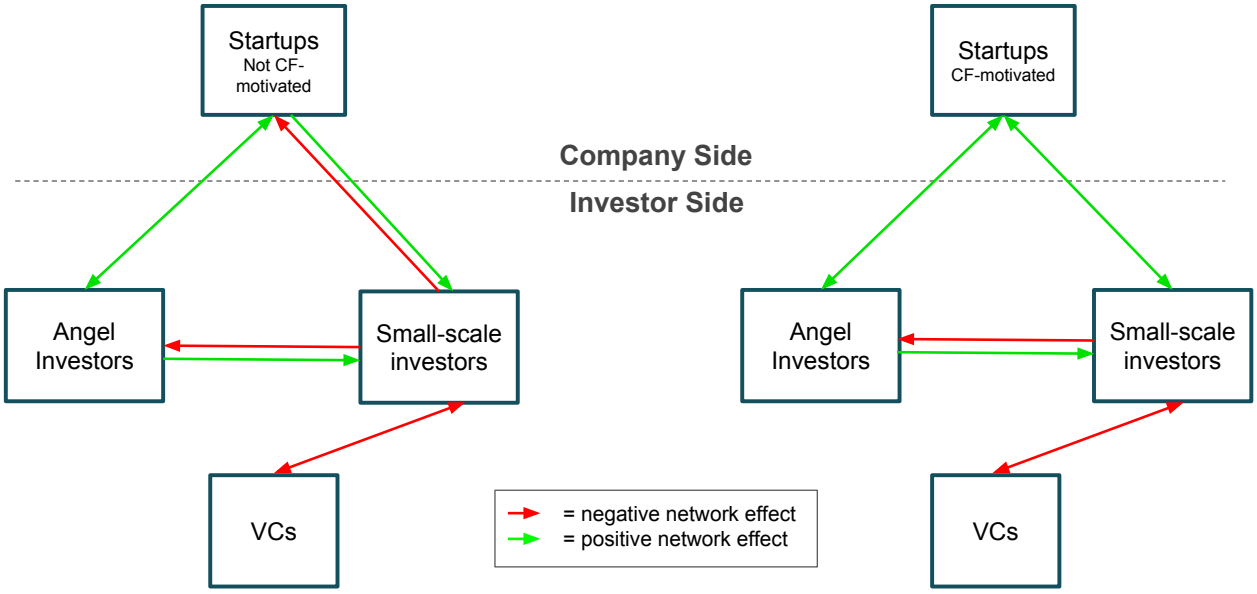


Figure 6.1: Network effects between stakeholders

6.2 Homing Costs

As described in chapter 3, homing costs is all expenses with establishing and maintaining affiliation with the platform. Since the platform is still under development, and the pricing model is not decided, we do not know if there will be some sort of subscription fee to the platform. We have therefore analyzed the homing costs for users of Startblock primarily using the administrative costs of registering and participating.

6.2.1 Investors

Financial services are required to be conducted in a safe manner. Users are therefore used to, and probably expect, proper security measurements, such as those seen in online banking. Trading of shares and integrating this with the users' personal shareholder tax report "Aksjeoppgaven" requires proper identification of the users (Skatteetaten, 2018b). The Norwegian tax authority accepts five electronic ID alternatives (Skatteetaten, 2018a). If the platform shall offer delivery of the shareholder tax report, then the requirement from the authorities is that users must do a proper registration process with one of these electronic ID alternatives.

As a comparison to Startblock, Nordnet, a Norwegian platform for trading shares on the stock exchange, offers identification through BankID, which is one of the five electronic ID alternatives. This shows that there are simple verification methods once registered. Furthermore, once on the platform, users should not experience much work except when they want to trade. However, many investors already use other platforms to buy shares. When using Startblock there will be the extra work of having to deal with an extra service to manage their stock portfolio. In summary, we see no reason why registration on Startblock should be more complex than on other share trading platforms.

6.2.2 Startups

When a startup uses Startblock, the startup's cap table will be managed by the platform. This is an exclusive solution, as the startup will have to interact with the platform for all its corporate actions, even if they were to use other services involved in raising equity and marketing their shares. A first cost is therefore that the startup must register itself on the platform. The administrative costs with registering will be present on any platform the startup uses for crowdfunding or to manage its cap table, so there are no extra costs associated with choosing and staying with Startblock's platform.

Next, there are two indirect costs for a startup to use the platform. First, the startup has to learn to use the services offered, and to use the platform to communicate with shareholders. The actual cost of this depends on the user interface design of the platform. When designing the user interface, Startblock should therefore take into consideration that these are the costs associated with startups' usage of the platform. The startups interviewed all mentioned administrative work and shareholder communication as nuisances in running the company, and if the Startblock platform is non-intuitive or difficult to use, then the homing costs increases.

The second indirect cost is that startups must persuade investors to register on and to use Startblock. The cost of persuading their investors to do this is naturally linked with the investors' homing costs, and thus startups' homing costs correlate with investors' homing costs.

Lastly, based on the pricing model, there might incur a subscription fee for companies to list their shares on the platform. It is important that Startblock balances this subscription fee with the value the startup gains, such that startups will not see the homing costs of the platform as unreasonable.

6.3 Switching Costs

As described in 3, switching costs are the costs that platform participants face when switching to another platform.

6.3.1 Investors

If a startup is registered on Startblock, and only uses the platform for one or several of its services, then its investors can be forced to use it too. Then the investor cannot switch to use another service, and consequently there are no switching costs. Also, as there currently seems to be no significant platform or solution competing with Startblock, it is unlikely that many investors will have much invested in other services that they have to abandon. This could change if the launch of Startblock takes a lot of time or if they later decide to enter other markets.

What regards cross-side switching costs, our impression is that an investor that wanted to also use the platform e.g. for managing the cap table of his or her separate startup, this could very easily be achieved. The personal identity on the platform would be the same, and this could for instance be given permission to operate on the behalf of the company entity. It also seems likely that company managers could decide to become individual investors themselves as well, and even that some companies could desire to – as a company – buy shares in other companies, if the platform was to allow this.

6.3.2 Startups

For startups, there is the option to move the shares off the platform. In this situation, the alternatives would be either to register on the Norwegian CSD, or to move back to the tools currently used today. All the startups we interviewed were using Microsoft Excel at the time of the interview, but one of the angel investors knew examples of startups that used other specialized capitalization table tools.

The direct costs of moving from Startblock to the CSD should not be much larger than moving from tools such as Excel, as Startblock at any moment of time would be able to output a capitalization table and a correct overview of share ownership in the startup (similar to one in Excel). The costs of moving from Startblock (back) to a spreadsheet could thus also be a trivial one, especially if Startblock would provide a way to export the capitalization table in a suitable format (e.g. as a csv-file). In any case, the cost would be the work hours put into the exportation. However, there could also be indirect costs from moving away from Startblock as it would decrease the availability of the shares, which could have an impact on the market price and the possibility to raise new equity.

6.4 Subsidy side

Deciding the subsidy side is a bit complicated. The meaningful subsidy side of Startblock's MSP model is dependent on the pricing model they choose, which was yet to be decided at the time of this writing. Nonetheless, by using the data from our research, we could make some predictions on who that would be willing to subsidize others. If DNB chooses to invest in Startblock and not gain direct profit on this investment, they will indirectly subsidize the users of the platform by paying part of its development. In our interview with DNB, they state that their incentive to subsidize the platform would be to retain more customers, and to monetize through other services. In our interview with them, they discussed both offering traditional financial services on the platform itself, as well as attracting new customers to the bank, where they can offer other financial services outside of the platform.

Among the startups, the picture is more complex. In the network-effect section, and through our survey, we learned that both investors and startups receive value from their interaction, and that both sides are willing to pay to use the service. Above 80% of small-scale investors said they had a wish to invest more in startups, and were willing to pay either a per-transaction-fee or a percentage fee. All crowdfunding-motivated startups were positive to use a platform for crowdfunding. The non-crowdfunding-motivated companies we interviewed said they would receive value through easier communication with investors and conduction of digital general assemblies.

When looking at which platform side that are to directly benefit the most from using the platform, at least in strictly economical terms, startups is the side that stands out. Both through raising significant amounts of capital in crowdfundings and by easier communication with and easier administration of the shareholder base, this platform side could easily be seen subsidizing the investor side. Although, ultimately, the investors would also own stakes in the startups, and in that way indirectly partake in the startups' costs of using the platform.

Chapter 7

Blockchain Architecture

This part of the framework covers the technological choices Startblock or any blockchain-based company has to make regarding the use of blockchain technology. As we described when introducing our framework in section 3.4, several different choices must be made. The stakeholders themselves do not have any preferences on the blockchain technology itself, but they have some functional requirements that the platform must meet. As explained in 4, in our research we created specific questions to stakeholders that could reveal these. Still, most of the stakeholder requirements for blockchain architecture come from our interviews with Startblock and through an analysis of their business model.

Throughout this chapter, we will look closer into some implications of the functional and technological requirements we have identified (see chapter 5, and discuss how we believe the blockchain architecture should be designed to maximize stakeholder value.

7.1 Permission Model

The permission model includes who has the right to read, write and commit to the blockchain. The perhaps most defining right is the right to commit to the blockchain, as this action controls what may actually be legit transactions. It is important for two reasons: First, it is heavily linked to the choice of consensus algorithm. Second, it controls the ownership of shares. The security of the blockchain, and therefore the ownership of shares, is dependent on the public and private keys of the users' accounts. If a user loses their private key, or transfers the ownership of shares to the wrong public key, then the shares are not redeemable unless there is a backup of the keys, or if there is an entity which can restore the correct ownership of the misplaced shares.

In our interview with Blockchangers, they claim that one of the key problems for blockchain-based platforms is key management. They further believe that their users have a zero tolerance for losing shares because of technical issues. In addition, several angel investors expressed their

concerns in the interviews around whether or not it would be possible to lose control of shares if the platform was decentralized. To meet the users' expectations of safety, the platform needs a mechanism to perform restoration. This can be achieved by only allowing Startblock to commit to the blockchain. In this way, Startblock can commit restorative transactions to the blockchain in cases of errors or mistakes. This also prevents other entities from committing faulty and malicious transactions.

Regarding the rights to write, that is, to create transactions, this is only needed for users that buy or sell shares, or when issuing new shares. It would therefore be beneficial if Startblock limits writing rights to users of the platform. This makes it easy to verify the identities of everyone trading on the platform, which is required by regulators to verify the legal ownership and provide the Startblock portfolio feature. In practice, Startblock could do this by verifying the identities of the members when they register on the platform, and to only accept transactions on the network that are signed by valid users. As an alternative solution, Startblock could do all key management for the users, and users would only have to log into the Startblock platform. With this method, all blockchain-related activities would be conducted back-end by Startblock, and write-actions could therefore be restricted to Startblock only.

As mentioned earlier, companies' shareholder registers are public information in Norway. The blockchain must therefore be publicly readable to meet this regulatory requirement. This can be done by storing the current state of the blockchain and granting this to anyone who requests it. In summary, this and the considerations described above argue for using a public permissioned blockchain. Our findings are visualized in figure 7.1.

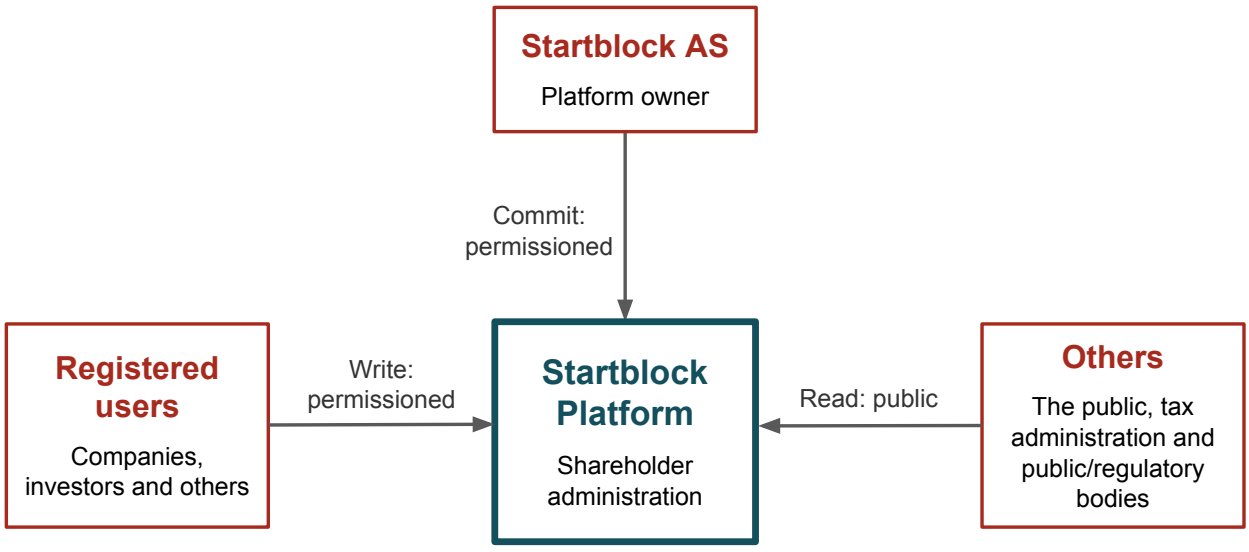


Figure 7.1: Permission model

7.2 Programming Language

The choice of programming language for Startblock is dependent on which features the platform should offer. The Startblock business model states that trading of shares is the main use of the blockchain (Blockchangers, 2018). From the survey with small-scale investors we found that they are interested in the following services:

- Overview of all investments
- Trading of shares
- Automatic reporting to "Altinn"
- An information channel from the companies they have invested in
- Electronic voting during general assemblies

From this, we do not identify any further requirements from the blockchain other than that it needs to provide a way to do simple transactions of an asset. Both trading of shares and electronic voting requires this. The rest are non-blockchain features. The requirement is therefore only that the platform needs a programming language that can run simple scripts. Further, the scripts do not necessarily have to be stateful scripts, as the transaction only changes state once. This means that the only restriction for the programming language is that it needs to be able to run such scripts.

7.3 Consensus Algorithm

Trading shares in unlisted companies is not an activity that an individual investor is expected to do several times a day, or even per week. Angel investors we talked to invest in just a handful of companies each, and small-scale investors estimate in our survey that they would invest in just a few startups if they had a chance and a well-designed platform to do this through. Given this, individual users would not conduct many activities on the blockchain itself. It is therefore unlikely that they would want to run validation nodes, as the investors would receive no extra benefit from doing so.

Once startups have conducted their fundraising, trading of their shares would not necessarily benefit them in any way. On the contrary, in our interviews, both angel investors and startups said they fear that excessive trading of shares could create noise for the company. At that point, the startup would have already received its money, and would probably be busy using the money to develop the company. We therefore consider it highly unlikely that would be interested in the extra cost and administration connected to running a validation node.

Given the above, having startups or investors run validation software is an unstable model as there are no proper incentives for them to remain active. Furthermore, the platform requires proper registration, and is run in a closed network where it is possible to control the access. The most beneficial would therefore be for the platform to use a Proof-of-Authority consensus algorithm. Proof-of-Authority (PoA) is a modified variant of the Proof-of-Stake where a node has the authority to create any block if it wishes so. The nodes should be run by Startblock itself. The amount of transactions per second would be low, as trading of shares in startups is not high-frequency trading, and in the scale of Norway the question is more in the hundreds per day, not per second, even in the case of Startblock obtaining a majority of the market. In any case, nodes running PoA algorithms are extremely scalable, and can have hundreds of transactions per second if needed. Finally, another benefit of running more than one node is that it also provides redundancy.

7.4 Transaction Model

The transaction model is the feature least dependent on stakeholders' requirements, as it does not provide users with other features. Its dependency on users is based only on the transaction speed necessary, as the UTXO model can handle more transactions than an account-model. From Startblock's business model, we see that trading of shares is the only activity on the platform that involves changes to the blockchain. The stock exchange in Norway, Oslo Børs, had in average 97 000 transactions per day, which translates to on average of around 1.1 transactions per second (Børs, 2017). In our survey with small-scale investors, they indicate that they would invest in fewer unlisted companies on a platform for this than they currently do on the stock exchange. This leads us to the conclusion that the transaction speed on the platform will be lower than on the traditional stock exchange, even in the case of full market penetration. In any case, with a PoA, the transaction requirements would have to be multiple thousands per second for there to be a need for a UTXO model. This is extremely unlikely for the platform, even if it expands to multiple countries. Therefore, the choice of transaction model is more influenced by the other blockchain architectural choices than by this, especially the choice of programming language.

From a development perspective, an account model is more intuitive than the UTXO model, and would be easier to develop and maintain. In this model, each user has its own account. However, for privacy reasons this could be changed to a system where each user has several accounts. In the end it is up to the developers at Blockchangers which model they are more comfortable developing.

Chapter 8

Solution Architecture

In this last tier and block of our framework, we use the results from the stakeholder analysis to see how the platform could be designed to maximize value creation. This design covers Startblock's governance structure, the products and services it is proposed to offer, and how it could gain revenue.

8.1 Products and Services

Gawer and Cusumano (2008) recommend platforms to first find an essential business problem to solve for an industry, which Startblock has already done, and to then facilitate and incentivize complementary innovations and products. If possible, these should be highly dependent on the platform, as this would maintain the switching costs to other platforms high.

Startblock's business model propose several products and services and a value propositions for the platform itself (Blockchangers, 2018). Through our stakeholder analysis, we have asked the different stakeholders which services they would use on the platform, if they were to be developed, and investigated how much value each service would create. In this section we have used the results from the architectural analysis together with specific input from stakeholders to find out which products and services that would maximize value creation on the platform.

Independent from the specific services, Startblock could decide to bundle two or more services together to strengthen their market position. Kazan and Damsgaard (2013) argue that by bundling services, platforms may strengthen their market position, both growing it and reducing the chance that some other company later can enter and win the platform's market. This could either be done through bundling together own services, or in cooperation with some external partner. An example of successful bundling is when Microsoft Windows offered Internet Explorer in a package with their operating system Windows (Kazan and Damsgaard, 2013). This

way Internet Explorer did not have to compete with its competing browsers on fair terms, and it quickly won a large market share.

8.1.1 Startblock Marketplace

The Startblock marketplace offers a secondhand market for trading shares in startups. When assessing which value this creates for stakeholders, it is meaningful to look at the investors' time perspective. Angel investors have a long-term perspective on their investment. Therefore, many of our interviewed angel investors said they did not want there to be a market for the shares, both because such would create an exit possibility for other investors, and it would also create noise for the company management. The goal of the angel investors is typically that the firm will someday be listed on the stock exchange or bought by a venture capitalist. For them, a second-hand market would bring more harm than value.

On the contrary, small-scale investors often have a shorter time perspective on their investments, and for them, a second-hand market is considered positive. They want to be able to sell shares when they need to. The larger the second-hand market would be, the more likely it would be that prices are fair, and that investors can sell and buy what they want when they want. If there existed a second-hand market, it would be easier for small-scale investors to invest in more startups.

For startups, a second-hand market does not give any direct value. Once shares are sold to investors, the trading of the shares does not benefit the firm. Several of the startups we interviewed said it might in fact be damaging, as they believe short-term price fluctuations could distract them from their long-term goals. However, the possibility to have a second-hand market would make it easier to raise money through crowdfunding, as small-scale investors would know that it is possible to sell the shares at a later time.

To summarize, we find that the proposed marketplace at Startblock would create positive value for small-scale investors, at best be neutral for startups and be negative for angel investors. A possible result of this could be that some startups would not want to conduct a crowdfunding on the platform if this meant their shared could later be freely traded on the marketplace.

8.1.2 Equity Crowdfunding Platform

In our stakeholder analysis, we saw that some startups are interested in crowdfunding and to create ties to their users through offering ownership, while some startups are more interested in raising equity and getting experienced investors as advisers to the company. We observed a strong interest from startups to use this service. The major concern against crowdfunding observed from angel investors and venture capitalists, and therefore also from some startups, is

that it makes the cap table messy, and that the startup has to communicate with many inexperienced investors. A possible solution to this, which was mentioned by several angel investors, would be to syndicate investments from small-scale investors.

A syndicated investment, operated by an investment manager, would meet the requirements of both small-scale investors (that they too can participate), angel investors and venture capitalists (less messy cap table) and startups (less inexperienced owners to communicate with). Thus, having a lot of small-scale investors as investors would not have any negative network effects on other stakeholders anymore. Furthermore, such a solution is technically feasible on blockchain, and the Startblock platform could also allow for transparent and securely control of the syndicates.

8.1.3 Startblock Cap Table

A service for automatically creating, updating, and reporting companies' cap table would certainly create value for startups. It would save them time and work, and it would also make it easier to comply with regulations. From our discussion with the Brønnøysund Register Centre (see section 5.2.2), we learned that they do not imagine that they would want to connect to different blockchains to read from and update their registers. Also, in the foreseeable future, it is not likely that they will have the ability to connect to APIs and get inputs through them. A governmental requirement for Startblock is therefore that the platform must have a mechanism to report the cap table in a conventional way. Alternatively, Startblock could let startups extract the data in a straightforward way and let them report it themselves.

However, the startups we talked to did not see the conventional reporting of the cap table as a large problem, and nor did the Brønnøysund Register. The main value for both startups and regulatory bodies would be that the cap table is correct and updated, even in the case of very many stock owners (as is often the case after crowdfunding), not that it is automatically reported. Also, for startups, an opportunity to easily communicate with their shareholders, i.e. an updated list of them, would also bring immense value over the current manually updated lists of email addresses some of them use.

8.1.4 Startblock Portfolio

Contrary to what Startblock's business model claim, we do not see any need from angel investors for a service to keep track of investments through a portfolio. Investors we interviewed made few changes to their portfolio annually, and had a long-term horizon on their investments. They therefore doubted that they would be willing to pay anything for it. For them, it would be more useful if they could actually have all of their investments in the same portfolio, but the service offered by Startblock is limited to shares in companies registered on the platform. Nevertheless,

Startblock could still give investors value by offering them an overview of their portfolio for free. However, it should be viewed as a core service in the same way bank deposits are shown in online banks, and not as something that creates extra value for investors or that they should pay for.

8.1.5 Digital General Assemblies and Voting

A service all actors on the platform are positive to is the ability to hold a digital general assembly and to cast a vote digitally. All small-scale investors, angel investors and startups mentioned this as a service they wanted. For startups it would remove a lot of administrative work, especially around signing papers and holding votes. The same is true for angel investors. Some angel investors have invested in very many companies, and it is unfeasible for them to attend all general assemblies. They instead typically rely on granting someone else in the assembly authority over their votes, often the chairman of the company. The ability to cast votes digitally would therefore make voting simpler and more precise, as they could participate themselves and change their votes after hearing arguments from the general assembly.

From a technological perspective, complying with legal requirements around voting is one of the major benefits from blockchain technology. Through digital signatures, shareholders could prove their ownership, and therefore also cast votes. Technically, this would allow for the whole general assembly to be digitized. We therefore see this as one of the strongest potential benefits from using a blockchain based platform.

8.1.6 Solving the Chicken-and-Egg Problem

In section 3.2.1 we described the chicken-and-egg. Briefly, this is the problem that it is difficult to attract one participant group to an MSP, e.g. sellers, if there are few participants from another group, e.g. buyers. But also vice versa. We also presented our simplified version of the platform loop in figure 3.2, adapted from Smedlund and Faghankhani (2015). Here we present some reflections on how to solve this issue.

Before Startblock can get any revenues at all, they need to attract market participants to join their platform. These participants, be it individual investors, private companies, or others, will not join until Startblock can offer something of surplus value for them – i.e. something that gives them more value than its homing costs. Homing costs, described in section 6, include the costs of obtaining, learning and using a product. Offering a product for free is one way to reduce homing costs and increase customer value.

The first two products and services described in above depend on a high number of participants and network effects to become valuable. For these, the chicken-and-egg problem is significant. If these were to be the only ideas for products and services they had, Startblock would most likely have been dependent on a collaboration with a larger existing business, e.g. through bundling their products together, to attract a critical mass of customers to start providing value themselves. However, the last two products mentioned above are less dependent on network effects and have much lower homing costs, in particular the Startblock Portfolio. Startblock could thus provide this core service to investors free of charge to attract their first platform participants.

As the number of investors using the Startblock platform increases, it will also be more interesting for companies to join the platform. An equity crowdfunding platform would be feasible to create even with a low number of investors and even just one company. By successfully developing and launching such a service, a part of the novel offering phase of the platform loop, the platform would attract even more investors (to take part in the crowdfunding) and companies (that are interested in this service). Then, it remains for Startblock to actually facilitate transactions between these two platform sides, another phase in the platform loop, during which they could also start to create revenues. When doing this sufficiently good and providing their customers with value, Startblock would be gradually locking their participants to the platform in a cyclical process, strengthening this effect the more novel services they provide and customers they attract.

If the self-enforcing platform loop stops, i.e. the platform becomes static, then Smedlund and Faghankhani (2015) argue that it will is much easier for competitors to copy a platform and offer participants to switch. To avoid this, platforms themselves need to keep up with the growth. This can be a real challenge with a fast and self-enforcing cyclical process of growth. Sandsmark and Palmers (2016) refers to this as a third dimension of the chicken-and-egg problem, and makes an argument that platform development should therefore be part of the cyclical process.

Startblock plans to introduce more products and services iteratively (Blockchangers, 2018), following the lean startup methodology as pioneered by Eric Ries (2011). Following this method, product improvements are made primarily based on market response. This makes sense from the perspective of continuously developing a platform and offering new novel products and services. However, the pressure is then high on successful product development, and novel features can be both expensive and time consuming to develop. If a platform grows fast, it can be challenging for the platform to keep up. A strategy suggested by Sandsmark and Palmers (2016) is then to implement existing third-party solutions in the platform where possible. A downside with this is the loss of control, to be discussed more in section 8.3. However, opening ones' APIs or equivalently not only provides an opportunity for new services to existing platform partic-

ipants and sides, but also an opportunity for new customer sides to join. Banks that want to utilize their platform and customer data to sell their own services is one specific example of interest for Startblock.

8.2 Revenue Model

In this section, we will discuss the choice of revenue models for Startblock for their proposed products and services, divided into some categories. Note that the revenue models we as researchers argue for and recommend below will be based on what gives most value to which stakeholder. Other priorities could lead to different assessments of this. All our findings and implied recommendations are illustrated in the details of figure 8.1.

8.2.1 Marketplace

The marketplace offers a service for investors to buy and sell shares. As we discussed in the previous section, this generates most value for investors. Our stakeholder analysis showed that small-scale investors are willing to pay either a fixed sum or a percentage of investments in brokerage fee, and that small-scale investors have a large cross-side network effect with startups. This is already standard on other stock brokerages, such as Nordnet, and investors are familiar with such a model. The users are both used to, and say they are willing to, pay a percentage in brokerage fee from the trading of shares, with a fixed minimum fee amount.

Startups do not gain any direct value from trading of their shares, and the only value for the startup is that a second-hand market exists. There is no reason for the startups to pay any extra fees for this service. This means that only the buyers and sellers can be expected to provide the revenue from the marketplace.

8.2.2 Crowdfunding

Crowdfunding has a lot of value for both investors and startups. In our platform analysis in section 5.1 we discussed the question of who benefits most of the crowdfunding, and landed on the conclusion that both investors and startups benefit, but that the money of the startup is indirectly the money of the investors. Charging investors with a fee in a crowdfunding may create a barrier to invest, and it might be better to allow startups to make the decision if paying a fee for a crowdfunding service is worth it or not.

By only charging the startup, it is easy for the startup to calculate the total cost of such a fundraiser, and this also hides the expenses for the new investors. It does, however, imply that those who

are already shareholders in the startup indirectly pay some of the cost. Nevertheless, it seems like the highest total stakeholder value would be achieved through charging startups with a percentage of the total crowdfunding amount in fees and not to charge anything of investors.

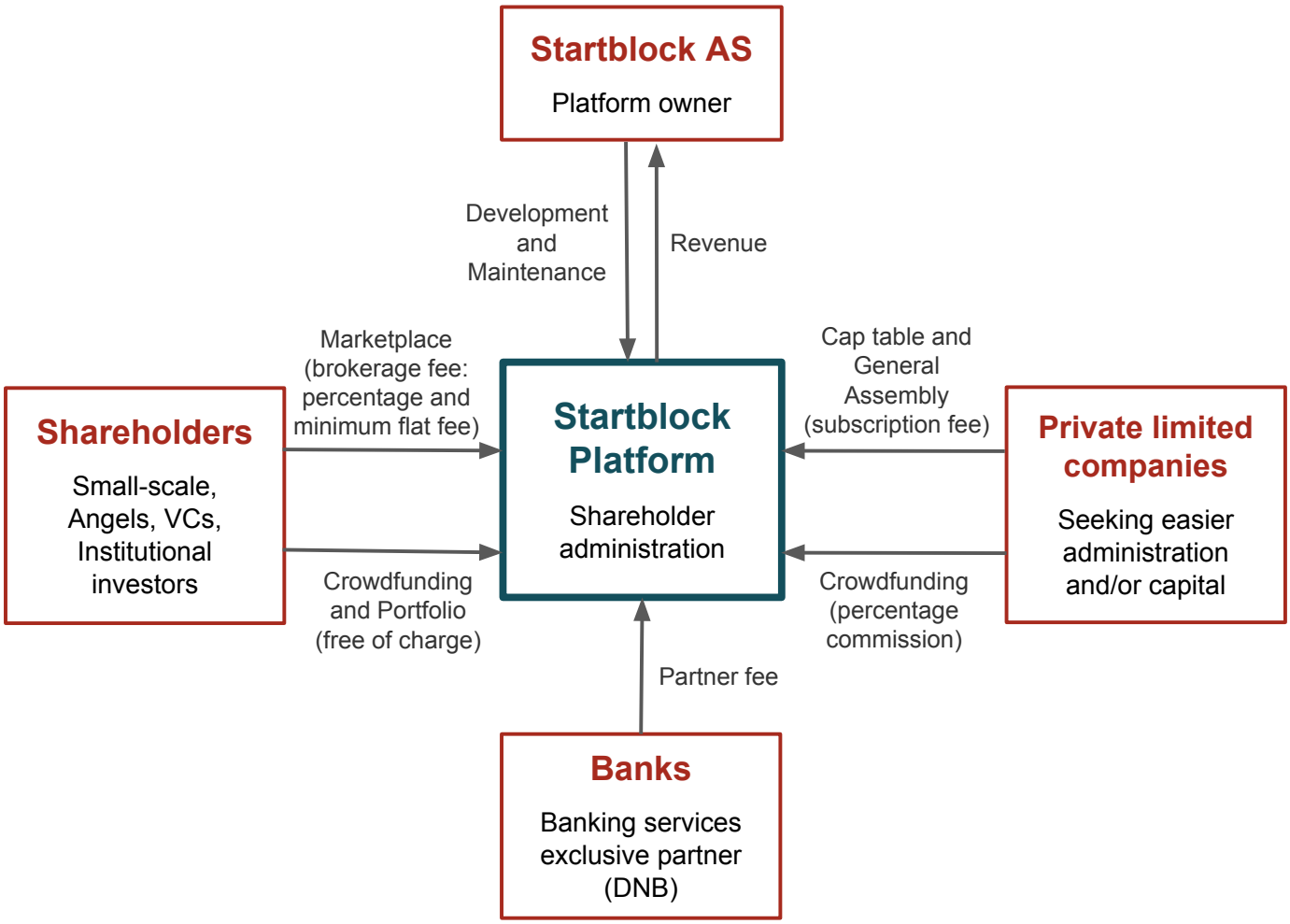


Figure 8.1: Revenue model

8.2.3 Services

In chapter 5 we show that startups are interested in several of the services Startblock have thought about developing, such as a digital general assembly, stakeholder communication, a second-hand market for their shares and a digital cap table. They do also to some degree have a willingness to pay for these. From our interviews with startups, we learned that several of them preferred a subscription model. This was according to the interview objects because it makes the costs more transparent, and, since startups are very cost focused, having an "all inclusive"-model would give security despite allowing them to have no leashes when it comes to the use of the services.

From the investors point of view, investors cannot be expected to pay just to own shares, over time gradually eating up their investments. Most investors, especially the smaller angel investors, did not see any great value of the portfolio service, and would not willing to pay anything extra for this. A subscription fee for investors could also greatly limit the willingness for investors to join the platform, and thus become an obstacle to creating the necessary and desired network effects of the platform. We therefore recommend Startblock to only charge a subscription fee for startups, and to let investors use their services for free.

8.3 Governance Structure

In the blockchain architecture analysis, we deduct that only Startblock would want to run verifying nodes, and they are the only entity which should have commit rights. We explain that this would best be achieved through a Proof-of-Authority model. In such a model, Startblock is the only node which creates blocks in the blockchain. This means Startblock is the only entity that can accept changes to the blockchain protocol, and they are probably the only actor to develop new code and features, although other actors might want to develop other applications through the platform. However, other actors would want to verify that transactions are done properly, and to extract data from the blockchain. It would therefore be beneficial of Startblock offers an API for actors, such as the tax authorities, to easily get data.

In the analysis on permission model, we showed that users of the platform require it to be managed properly and securely, and that someone is in charge and responsible to prevent loss of assets and malicious behavior. We further argued that Startblock, as the developer of the platform, would be best suited to maintain the cryptographic key-handling for participants. Startblock is also the only actor which has an incentive to run nodes on the blockchain network. As an implication of this, a natural governance structure would be that Startblock does most of the other management of the platform. In this, we mean that they could develop and verify new code, verify transactions, and create blocks, and control who can create transactions. In essence, they would act as a central authority, but can themselves be controlled by other users through the blockchain ledger.

Having a central authority does not mean the platform will be a closed platform. Other third parties could still contribute to the platform by developing new services on the platform or by using Startblock's API. The only caveat would be that Startblock would need to verify any code that runs on the platform, if it were to be the main developer. Further openness comes if anyone can be able to join the platform, and if there are no restrictions on membership, for example that users are not required to be customers of DNB or any other bank.

Restricting access to Startblock would restrict their potential user base, and thus also the startups ability to do crowdfunding. Unless this gave other benefits, this would consequently limit the value provided from Startblock to startups. Also, according to current sponsor theory, consumers prefer to access products without interference by sponsors (Casadesus-Masanell and Zhu, 2013). Lastly, governmental regulations require that stock ownership are available for everybody. For Startblock, this means that everybody must be able to read the blockchain, without restrictions.

Part III

Discussion and Conclusions

Chapter 9

Case Study Findings

The following sections discuss the findings in our case study concerning the main contributions of this thesis: the framework developed and stakeholder value theory, as well as the central theoretical concepts BMI and MSP. Further, it discusses the limitations of our research and its implications for both practitioners and researchers.

9.1 Framework Design

Through the case study we have demonstrated how our framework can be applied on a blockchain-based MSP. After conducting an analysis of all stakeholders of our case study, we argued for what we believe to be the best-suited blockchain architecture for Startblock, and which types of products and services we believe would maximize the value creation of the platform. Interestingly, according to our analysis, some of the products the platform initially wanted to offer, such as the portfolio, would not provide a lot of value for the stakeholders. However, new opportunities for value creation were also identified. To illustrate these, and the stakeholder requirements they should meet, we proposed some new ideas for services, such as to facilitate syndicated investments. During the case study, no changes were made to the framework. However, we made several observations on how the various parts of the framework affect each other. We would like to emphasize three of these experiences, as they have implications for how the framework should be used further.

First, both the platform architecture and blockchain architecture affect the other, and there are several dependencies between these two blocks. In our case study, we had network effects from the platform architecture affect both the permission model and consensus model in the blockchain architecture. Still, modeling the blocks of our framework in a sequence would in our opinion not represent the model in a better way. One reason for this is that grouping the architecture into technology and platform makes the model more structured. This also allows

the technology block to be replaced by another technology if desired. Further, both architecture parts are to be performed at the same stage in the model. Trying to create a sequence of steps is difficult because they both affect each other. An example seen in our case study is that the blockchain architecture influenced the homing costs and switching costs. The framework developed prior to the case study should therefore remain as described in section 3.4.

A second experience is that it is difficult to get input directly from stakeholders on the blockchain architecture, and presumably on any specific advanced technology at all. Our framework follows a stakeholder analysis approach, and our case study analysis leans heavily on data from the stakeholders themselves. On the technology part, however, this was challenging to achieve for primarily two reasons: First, most stakeholders did not know much about blockchain. Secondly, in our case study and presumably also in many other companies, the existing business model or services offered had already put strong constraints on the technology architecture. For example, the fact that Startblock wants to offer trading of assets, in this case shares, means that the blockchain needs a programming language for smart contracts. We therefore focused our stakeholders' input on the other parts of our framework, and on their general requirements of the platform, and attempted to ourselves deduce the most suitable blockchain architecture based on this. Hence, the technology analysis of our framework requires less resources spent on data gathering than the platform analysis, although some should be spent on seeking expert advice.

The third and last experience to be discussed here is that the blockchain architecture foreshadows the governance structure through the permission model and consensus algorithm components. This means that some of the solution architecture can be directly deduced from decisions taken in the blockchain architecture analysis. However, the full governance structure cannot be completed until all products and services on the platform have been described, which might demand several iterations of analysis in both the platform and blockchain part of the analysis.

9.2 Stakeholder Theory

9.2.1 Value Creation

In chapter 3, we described how previous research on stakeholder theory is divided in its view on value, where some measure value purely in economical terms, while others, such as (Argandoña, 2011), argues that value can be measured in several ways. In our analysis, we pursued the idea that value comes from more than economical gains. By following this idea we were able to capture value for some stakeholders in a better way, such as for regulators. Also, by only focusing on economic values such as revenues and costs, we would not have captured the value

that new services can provide for investors. Through our empirical results, we therefore find that value can, and should, be measured in several ways. Identifying what creates value for each stakeholder should consequently be part of the stakeholder analysis.

9.2.2 Stakeholder Analysis

When applying our framework, we found that it is crucial to do a proper stakeholder analysis in order to gain enough insight into the relevant industry. In the stakeholder identification phase, we identified all stakeholders and then gathered information from them. The qualitative interviews with subject matter experts early in our analysis phase gave us particularly important insights. Among other things, they helped us discover areas where the Norwegian ecosystem is different from other ecosystems, especially the American one which we already had gained some knowledge about through literature.

The importance of assessing each country and market individually, not assuming common traits, is especially important when it comes to regulations. Knowledge of some ecosystems cannot automatically be transferred to another. When using our framework, it is therefore important to tap into local knowledge to be able to conduct an accurate analysis. Jepsen and Eskerod (2009) showed that one of the problems with conducting stakeholder analysis is that it requires resources and is time-consuming. We still believe it is worth the investment, and – logically enough – especially when the researchers have limited prior knowledge of the field and how different stakeholders operate.

Further, understanding the stakeholders' requirements is a necessity to choose the blockchain-architecture that gives the highest value creation. In blockchain, it is possible to choose many different combinations of design models, which can give different results. In our case, it was particularly important to understand who would run verification nodes, and which consensus algorithm that should be used. A different design here could have introduced a demand for mining, which would have implied a completely different revenue model, as also miners would have needed some form of incentive. This fact has been observed on several other platforms also using a permissioned model, such as Ripple (2018). Another factor we saw that underlines this importance, is that blockchain architecture is difficult to change once designed, so once a choice has been made, it will likely stay this way.

Finally, the whole ecosystem should be a part of the stakeholder analysis. Kazan and Damsgaard (2013) only analyze the actors of the platform to understand network effects. However, in our case study, some of the stakeholders outside the platform, such as the venture capitalists and public regulators, could have a just as important impact on network effects as the more active participants have.

9.2.3 Stakeholders vs. Shareholders

As described in chapter 3, there is a discussion in stakeholder theory regarding stakeholder interests vs. shareholder interests. In our framework and analysis, the idea is that the platform thrives through maximizing value for the users. This is an obvious advantage for the shareholders of the platform itself, in our case Startblock AS. We have seen more conflict of interests between the different stakeholders, than between stakeholders and shareholders. For example, who should be paying for the services, and who has an interest in governing the platform. Hence, on MSPs, the discussion about stakeholder interests vs shareholder interests seems to be less relevant, and the dilemma seems to rather be about balancing the interest of the different stakeholders.

9.3 Blockchain as a BMI

Lindgardt et al. (2009) explain how business model innovation may disrupt and change the economic logic of an industry. Although online trading platforms are not a new invention, to use blockchain as the underlying architecture, and thereby to enable all the benefits of blockchain technology, is a new innovation. As we describe in our previous work, blockchain is used to lower infrastructure cost through, among other, faster systems and cryptographic signatures (Forselv et al., 2017). A further innovation, which differentiates Startblock from traditional trading platforms, is that it combines crowdfunding with a marketplace. By doing this, the platform creates an alternative to listing stocks on traditional stock exchanges.

In chapter 3, we describe how Airbnb gained a competitive advantage through their innovative business model. As with Airbnb, it may be difficult to imitate Startblock's BM. In addition, by utilizing the first-mover-advantage, such a platform may do well in a "winner-takes-all"-market as both investors and startups would prefer to join a platform where the users are – where positive network effects are already in place. This is similar to how other market leaders such as Facebook and Amazon have grown. Our study therefore indicates that the use of blockchain technology may be well suited to innovate business models, and to achieve a competitive advantage by changing the logic of the industry.

9.4 Multi-Sided Platforms

9.4.1 Stakeholder Analysis in MSP Frameworks

In our framework, we introduced the use of stakeholder analysis into MSP theory. Previously created MSP frameworks, such as that of Hagiu and Wright (2015b) and Kazan and Damsgaard (2013), focused mostly on an analysis of network effects and current costs. Thereby they could, according to Kazan and Damsgaard, be used to analyze the current market position and to change the platform if needed. This is similar to what we have done. However, by using a stakeholder analysis, our framework also focuses on identifying the needs and requirements of the actors who have interests in or participate on the platform, and to meet these. Further, our framework has less emphasis on how lock-in effects and homing costs places the platform in the market, but rather on how such factors have an influence on the technology solution.

Next, we introduced the notion of value, and to measure value in different forms. All of these factors have some distinct effects. The focus on stakeholder analysis meant that we capture more stakeholders in the ecosystem. By identifying these stakeholders' values and needs, we were able to identify more requirements to the platform. Consequently, our framework gives a more detailed and holistic analysis. The ability to identify new services through the stakeholder analysis is a particularly noticeable advantage compared to previous frameworks.

9.4.2 The Use of Blockchain on MSPs

We have seen that one of the most prominent advantages of using blockchain technology on MSPs is the ability to prove ownership of assets. In our case study, we saw that this enables both trading and voting. In the stock market this could be used to, among other things, buy and sell shares and to cast votes in (digital or physical) general assemblies. In other use cases, or on different platforms, there are other advantages of blockchain technology that may be utilized. In our previous article, we argued that these advantages can be used to improve back-end processes between actors in the B2B-market, where we argued that there is a higher degree of trust than in the B2C-market (Forselv et al., 2017). In this study, we explored a case where the trust-model is different: The Startblock platform offers services in both B2C and C2C, where the trust that a transaction is conducted correctly lies in the platform itself, and where consumers would not necessarily even notice if the platform uses blockchain technology or not.

Unless Startblock is to give its users control over their keys and create a truly decentralized platform, the difference between using blockchain or not would be indistinguishable for customers. Therefore, for centralized multi-sided platforms, the most significant advantage of blockchain technology is that it provides sufficient trust both for other businesses and, perhaps most im-

portantly, for regulators. However, in our study, we also learned that public regulations are not keeping up with the development of blockchain technology. Creators of blockchain-based MSPs should therefore know that both regulations and how public bodies want to interact with these platforms might change in the future. Nevertheless, we found that regulators are interested in cooperating with and learning from tech-entrepreneurs, not to work against them.

9.4.3 The Analysis of Network Effects

A revision of the stakeholder ecosystem during data gathering will often be necessary. In some cases, stakeholders may be different from what assessed in the initial stakeholder identification process. When analyzing the stakeholder ecosystem, we had to divide stakeholder groups into sub-groups to accurately understand their requirements. During our initial identification of the stakeholder ecosystem, we saw that investors had to be divided into sub-groups. However, with startups, it was only as we started to interview them that we learned about their diverse set of needs, and that they too had to be split into two different sub-groups.

Further, the terminology "network effects" is a too broad term to be used in stakeholder analysis as there can be both positive and negative network effects within a group. In our case we saw that within the investor groups, angel investors received both positive and negative network effects from small-scale investors. Van Alstyne et al. (2016) mention three metrics that can be used to understand network effects. These are *engagement*, which tracks the level of platform participation from the different customer sides, *matching quality* that tells how good the fit between the different participant sides is (e.g. how much of the content on a marketplace that a user clicks on or reads), and *interaction failure* – how often a platform fails to serve its purpose (e.g. a search on a marketplace gives no results). These metrics should be refined and be added to, or even replace, the network effects in our framework. Kazan and Damsgaard (2013) only measure network effects through the number of participants. This is too oversimplified for an analysis in our framework as we have seen that there are indeed several positive or negative effects other than just the numbers of users.

To achieve network effects, a new platform must first overcome the well-known chicken-and-egg problem. In our research and case study we found that new MSPs would benefit from initially providing some core service to a single platform customer side, with low upfront homing costs and to no or low expense. This way the MSP can quickly attain a mass of at least one desired platform customer group, and when a critical mass is obtained, then the MSP would be much better able to introduce their more typical platform services and create network effects.

9.5 Limitations

Our study has primarily three limitations. First, we did not interview venture capitalists. The two main reasons for this is that they are not seen as participants of the platform, and it is hard to get access to interviews with them as there are not that many experienced venture capitalists in Norway. We assessed them only based on the experience and views of angel investors, especially those most similar to VCs in terms of investment strategies. Thus, our analysis on venture capitalists is based on second-hand sources. We could therefore not ask venture capitalists questions of interest to us such as: if their view on small-scale investors would change if they were convinced that many of the problems with a messy cap table could be fixed through blockchain, or if a syndication of investments would be a promising idea. However, some of our interviewed angel investors have extensive experience from working with VCs. We therefore assess the reliability of their input on venture capitalists as good.

The second limitation is around our small-scale investor survey. In our survey there are several answers that may be inconsistent or implausible, for example around how much some small-scale investors claim they would like to invest in startups given that the Startblock platform is developed, Different factors affecting the reliability of these answers, such as peacocking and pleasing, are discussed in section 4.3.2. We also have a disproportional large group of students as respondents in our survey, presumably due to the forums we shared our survey in, which may have given us biased and unrepresentative answers. Building on this concern, we are also not certain that we have surveyed the right segment of small-scale investors. In retrospect, we could have done some research on how the population of small-scale investors in Norway look like, and then worked targeted towards obtaining a similar representation in our survey group. This especially regards the sex distribution. Also, we could have tried to collaborate with a bank or Nordnet to have our survey distributed to some of their customers.

Third, the analysis of the framework is dependent on different stakeholders' inputs. Blockchain technology is a new and technically complex technology to understand, especially for people without a technical background. This causes some problems when mapping what stakeholders want, because they might not know it themselves, or have opinions based on misunderstandings. In our data gathering we solved this by mapping all blockchain requirements to questions that could seem completely unrelated to the technology, and that were intended to make sense to all stakeholders. Some information might have been lost in this mapping. However, in doing this, we avoided that stakeholders focused too heavily on the limits of (their knowledge of) technology, and thus a possibility to miss out on the truly revolutionizing services they desired. The businessman Henry Ford illustrated this point well: "If I had asked people what they wanted, they would have said faster horses."

9.6 Implications

9.6.1 Implications for Practitioners

We have demonstrated how the framework can be used to design the platform and blockchain architecture, government structure and revenue model for a blockchain-based MSP under development. The framework can both be used by startups designing a new platform and by organizations with existing platforms. Startups can use the framework in the same way we have done in this thesis, evaluating strengths, weaknesses, threats and opportunities of their idea. The framework should preferably be applied after the business model has been formed, but before the choice of blockchain technology has been made. To make the framework easier to apply to a development project, we suggest that the stakeholder analysis can be integrated with a market-analysis, as the market analysis gives much input to the second level of the framework.

For existing platforms, it may not be possible to change existing blockchain architecture. However, they can use the stakeholder analysis to better understand if their current revenue model is the most efficient, or if they can increase value creation by changing existing services or offering new services. As mentioned, the framework can be adapted to be used by any technology-based MSP by replacing the blockchain technology by the technology of interest.

9.6.2 Implications for Researchers

Implications for Multi-Sided Platforms

We could not have properly identified the dynamics between platform actors without doing the stakeholder analysis. Not until all stakeholders had been interviewed did we get the full and correct picture. A simplified analysis could have found that, and for a long time this was also our view, the more investors there are on the platform, the better it is for startups. However, when investigating this more closely, some startups turned out to only be interested in some particular investors, and even received negative effects from other investors. Researchers should therefore be careful when doing a superficial analysis of network effects as the complete ecosystem may be complicated.

Further, the definition of network effects should be expanded. Some previous studies only measure network effects by the number of participants. This metric is not detailed enough for our framework, and we agree with Van Alstyne et al. (2016) that both engagement and matching quality are parameters that should be considered parts of network effects.

Finally, for technology-based MSPs, through the case-study, we have shown that technology must be taken into consideration in the same way as network effects to maximize value cre-

ation. The technological aspects have significant impact on network effects, and vice versa. Consequently, offering the right services with a fair revenue model, and thereby maximizing value creation, requires the right choice of technology. Any analysis of MSPs must therefore include a platform-specific technology part.

Implications for Blockchain-Based Platforms

Initially in the creation of the framework we assessed that the business model and initial stakeholder identification would give sufficient input to the blockchain architecture. However, during the case study we learned that the network effects on the platform put strong limitations on the blockchain model. Especially understanding what gives the stakeholders value will impact mining and node control, as entirely different revenue and governance models may be chosen based on how the stakeholders behave.

We have also learned that it is possible to create blockchain-based platforms for consumers without using a cryptocurrency or a token. Currently, many of the large platforms, such as Ripple (2018), use tokens and wealth transfer as a core service. Our case study, Startblock, use blockchain as an underlying technology. This is elsewhere mostly seen used within a company or in B2B through a consortium, such as Hyperledger Fabric (Hyperledger, 2018), but this is one of the few examples where blockchain is used on a platform for consumers. The benefit of blockchain that Startblock tries to leverage is the ability to prove ownership. The proposal of such usage is not new, but Startblock is one of the first examples where it is applied. Researchers on blockchain technology should therefore pay attention to Startblock's fate, as it is one of the early movers in applying this technology.

Chapter 10

Summary and Conclusions

10.1 Conclusions

At the start of this thesis, we explained the overarching purpose of the paper through two research questions. The first, RQ1: How can a framework for analyzing MSPs be adapted to fit blockchain-based products and services. And second, RQ2: How can a blockchain-based platform create value for different stakeholders? These are discussed below, together with some other of our central findings.

10.1.1 RQ1: The Framework

To answer our first research question, we combined previous research and ideas on stakeholder theory with existing MSP-frameworks to create a new framework. The main focus of this framework is to maximize value creation, and it does so by taking all stakeholders requirements into account – requirements identified through a stakeholder analysis. The developed framework consists of three steps. The first step concerns a platform's value proposition and ecosystem of stakeholders. The second step is split into two parts: a platform specific and a technology-specific part – in our case focused on blockchain technology. Lastly, the third step concerns the solution structure of the platform. Through these three steps of the framework, one can both identify and analyze several design choices that increase value creation for the stakeholders of an MSP.

We found that the platform and blockchain architecture affect each other in many ways, and thus should be tightly connected in the framework and analyzed simultaneously. Also, we found that although the final solution structure of an MSP cannot be decided on before the end of an analysis, there are parts of the governance structure that can be directly deduced from decisions on the blockchain architecture. Lastly, we found that questions related to the blockchain architecture, and presumably questions regarding technology in general, were hard to get direct

input on from stakeholders, who often do not have sufficient knowledge on the topic. However, through mapping such questions to more understandable and application-related questions this issue can be solved, and this worked well for our case study.

To demonstrate and evaluate the usefulness of our framework, we applied it to the startup Startblock. By following the steps of a stakeholder analysis, we first identified the stakeholder ecosystem of the platform, and then interviewed stakeholders to understand what value the Startblock platform could provide to them, and which requirements they had. These results were then used to discuss different design choices for Startblock's blockchain-architecture. Furthermore, in the last step, we drew some conclusions regarding the governance structure and revenue model of Startblock.

The details of our case study analysis are described in chapter 5-8. To give some examples, we found that Startblock should use a public permissioned blockchain to fulfill the requirements of their stakeholders. Next, that they should introduce a service subscription fee for startups on the platform – but not for investors, and that some core services should be introduced on the platform before those with network effects can successfully be launched. Finally, in chapter 9 we have put the findings of our framework in a larger academic picture by giving advice to both practitioners and researchers.

10.1.2 RQ2: Stakeholder Value Creation

By applying our framework on our case study, Startblock, we have seen how value can be created for a diverse set of stakeholders of an MSP. In chapter 1 we declared our interpretation of value as anything that has the potential to be worth something to a stakeholder. We therefore defined value individually for each stakeholder at the beginning of the stakeholder analysis (chapter 5). Our finding was that all stakeholders except regulators have an economic perspective on value. However, value was not measured strictly in monetary terms, but in terms of their ability to have some certain needs fulfilled.

For companies and investors interested in our case study, Startblock, their needs were primarily the ability to further grow their business and the possibility to find more good investments, respectively. Regulators, on the other hand, were more concerned with regulatory value; making sure companies under their jurisdiction complied with laws and regulation. They could do this through better interaction with these companies. In essence, we see that platform services themselves do not create significant economic value, but that they give different value to different stakeholders by answering their individual needs and enabling them to interact more and better with others.

In chapter 8, we showed that Startblock could facilitate value creation primarily through three types of core services:

- Enable trading of assets
- Save costs
- Facilitate better compliance to regulatory requirements

The Startblock platform seeks to offer all these service types through the use of blockchain technology. Blockchain is found to be particularly well suited to a few of the specific services Startblock has considered, such as voting in electronic general assemblies, which is possible using the digital cryptographic signing that blockchain makes possible. This signing-property gives blockchain-based MSPs a broadly applicable competitive edge over other MSPs, and it could be utilized to increase stakeholder value creation in many different use cases.

10.1.3 Other Findings

In chapter 9, we discuss the results of our case study analysis and the implications of these. This section briefly summarizes some of them.

Value Creation

Often, value is measured only in terms of economic value or profit. However, we have seen that a platform can create value in many different ways, also non-economic. Value may moreover mean different things for different stakeholders, and precisely what is not always immediately apparent – especially for the more peripheral participant groups on an MSP. When applying our framework, one should therefore begin with a stakeholder analysis.

Network Effects

The term network effects is by multiple other BM frameworks measured only in terms of the number of participants on a platform. We argue that there are several more nuanced metrics that helps measure network effects, such as the matching quality and engagement of platform participants, and that all of these should be included in an analysis of network effects.

Blockchain Technology in Business Model Innovation

Blockchain technology has opportunities to be used in BMI to gain competitive advantage. We have identified some of the strongest benefits of blockchain within permissioned MSPs, such as the ability to generate trust in B2B models or with regulators.

10.2 Recommendations for Further Work

Although we are of the opinion that this thesis answers our initially defined research questions, we have throughout our work discovered several topics where further work and research would be of interest. We discuss three of them below.

This thesis has developed a framework and applied it to a case study MSP. It would be of large interest to see if our framework holds just as well on other blockchain-based platforms, and then especially for platforms that typically would not use a centralized Proof-of-Authority model. Would the platform and stakeholder analysis work just as well when applied on a decentralized blockchain platform using, e.g., a Proof-of-Stake or Proof-of-Work? The use of such consensus models would create the need for miners, a new and essential stakeholder group, which would lead to a different stakeholder analysis. It would be interesting to see which impact miners would have on both the value creation of the platform and on the network effects.

A second topic for further research is to see if our framework can be applied to different technologies than blockchain. This can be done by replacing the blockchain architecture block with a different technology architecture. We are not certain that there is the same need for a technology block without blockchain, as blockchain has so many different combinations and options. However, we believe the choice of technology architecture would still affect the platform architecture, and vice versa, and that the framework can be adapted to almost any technology as long as it follows the described stakeholder analysis.

Lastly, to further test the applicability of our framework, it could be applied to an already existing MSP. We applied it to a platform business model still under development, which gave us the benefit that we could think quite freely – few strict choices and decisions had already been made. It did, however, limit us when analyzing some platform effects, for example homing costs and switching costs. Applying the framework on an existing platform would remove the hypothetical assumptions we had to make, and could further test the applicability of all the platform effects.

Part IV

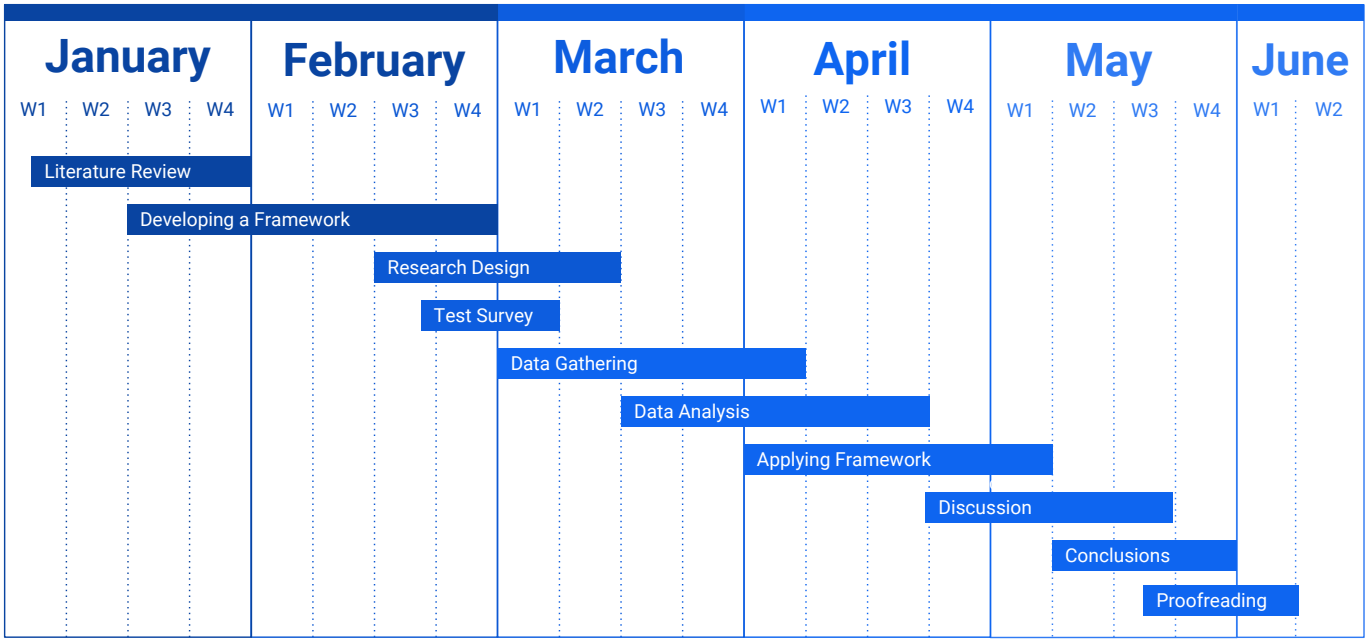
Appendices

Appendix A

Timeline of our Research

Initiating our research, we decided to divide our work into two large phases: pre-framework and post-framework, as these were quite different in terms of which tasks we could accomplish. Then we divided our accessible time up into several sprints ranging from two to seven weeks according to how much time we believed we would be working on something, trying to be realistic and not overambitious. We made this timeline in order to plan our work, use them as milestones and to see beforehand which tasks would have to be performed in which order, or in parallel.

The following timeline was finished and not changed anymore after the end of February 2018, and we more or less managed to stick to our plan.



Appendix B

Meetings and Interviews

B.1 Meetings with Supervisors

This list does not include written communication and short feedback in writing, as has been our primary form of communication with Blockchangers AS after the first month of research.

Date and with whom	Purpose	Duration and format
11.12.2017 Blockchangers	Discuss possible cooperation around our thesis and ideas for our problem description, among them Startblock	40 min Online
08.01.2018 Supervisor	Get to know each other, discuss requirements to the thesis and evaluate Startblock as a case-study	60 min Online
09.01.2018 Blockchangers	Q&A about Startblock and to discuss some problem descriptions and ways to use Startblock and relevant literature that we had prepared in advance	60 min Their offices
10.01.2018 Supervisor	Discuss feedback from Blockchangers and different possibles contributions to research (research areas discussed: market analyses, high tech innovation, business models and revenue models)	75 min Online
12.01.2018 Blockchangers	Discuss rough structure proposal of master thesis and research questions of interest	60 min Their offices
16.01.2018 Supervisor	Discuss first proposal for research questions and literature focus area:multi-sided platforms (MSPs)	60 min Online

23.01.2018 Blockchangers	Q&A related to our framework development, about platform characteristics for blockchain based companies and stakeholders in the Startblock ecosystem	70 min Their offices
30.01.2018 Supervisor	Discuss theory found through literature search and the working version of our framework for analysis	60 min NTNU
07.02.2018 Blockchangers	Present draft overview of stakeholders and ecosystem for Blockchangers, for construct validation	60 min Their offices
21.02.2018 Supervisor	Get feedback on draft survey for small-scale investors.	60 min NTNU
02.03.2018 Supervisor	Get feedback on draft of thesis structure and the theory chapter (our framework)	80 min NTNU
26.03.2018 Supervisor	Discuss interview results and analysis methods.	45 min Online
11.04.2018 Supervisor	Get feedback on introduction, background and theory, and discuss structure of analysis	60 min NTNU
09.05.2018 Supervisor	Get feedback on draft thesis, with focus on analysis and discussion	60 min NTNU
22.05.2018 Supervisor	Feedback on final draft for thesis	35 min Online

B.2 Interviews with Angel Investors

Date	Interviewee	Duration	Format
08.03.2018	Svein Anders Tunheim, Vallenus AS	40 min	Online
12.03.2018	Truls Johansen	40 min	NTNU
19.03.2018	Trond Riiber Knudsen, TRK Group AS	40 min	Oslo
20.03.2018	Bendik Heiberg	40 min	Online
22.03.2018	Bjarne Melbye, Tomorrow Today AS	50 min	Phone

B.3 Interviews with Startups

Date	Interviewee	Duration	Format
28.03.2018	Peter Vollen, CEO - HPG AS	40 min	Phone
31.03.2018	Sigrun Syverund, CEO - Fjong Norge AS	40 min	Phone
03.04.2018	Lars Flesland, CEO - Flowmotion Technologies AS	50 min	Oslo
05.04.2018	Harald Manheim, CTO - Moviemask AS	40 min	Oslo
12.04.2018	Kjetil Moløkken-Østvold, CEO - Upwave Technologies AS	15 min	Phone

B.4 Other Interviews

Date	Interviewee	Duration	Format
07.03.2018	Sverre Hovland, Senior Registry Management Adviser. The Brønnøysund Register	45 min	Phone
05.04.2018	Anders Skjærholt, Business Developer. DNB Open Banking	40 min	Phone

Appendix C

Interview Guides and Survey

Below follow our survey that we distributed online, as well as the two interview guides that were used as a basis for our semi-structured, open-ended interviews. Both the survey and the interviews were conducted in Norwegian and are therefore also presented in Norwegian here. In addition, the interview guides were somewhat customized before each interview to fit the interviewee, so the actual questions and phrasing may have differed from the interview guide.

C.1 Survey Questions to Small-Scale Investors

	Investeringer i børsnoterte aksjer:
1	I hvor mange børsnoterte selskaper eier du aksjer?
2	Hva er omtrentlig verdi av dine børsnoterte aksjer?
	Investeringer i oppstartsselskaper/unoterte selskaper:
3	Hvor mange oppstartsselskaper har du investert i totalt de siste 10 årene?
4	Hvor mye investerte du per oppstartsselskap (i gjennomsnitt)?
5	Hvor mange ganger har du investert gjennom en crowdfunding de siste 10 årene?
6	Hvor mye investerte du per crowdfunding (i gjennomsnitt)?
	Skatteinsentivordningen:
7	Hvor godt kjenner du til skatteinsentivordningen?
8	Hvor sannsynlig er det at du vil investere mer i oppstartsselskaper/unoterte selskaper på grunn av skatteinsentivordningen?
9	Hvor interessant er det for deg med en digital platform som gjør det lettere å

	utnytte og benytte seg av skatteinsentivordningen?
	Markedsplass for aksjer i oppstartsselskaper/unoterte selskaper:
10	Hvor sannsynlig er det at du ville tatt i bruk en digital plattform som gjorde det lettere å finne oppstartsselskaper/unoterte selskaper å investere i?
11	Hvor sannsynlig er det at du ville investert mer i oppstartsselskaper/unoterte selskaper hvis det fantes en digital plattform som gjorde det enkelt å kjøpe og selge aksjer i slike selskaper?
12	Hvor interessant ville det vært for deg å kunne spre dine investeringer på mange oppstartsselskaper?
13	Hvilke funksjoner ville du ønsket deg på en slik plattform? Velg maks 3 av de du synes er viktigst.
	Hvis "Ganske sannsynlig" eller "Svært sannsynlig" på spørsmål 10 eller 11, og med et antatt godt utvalg av selskaper tilgjengelig:
14	Hvor mange selskaper kunne du tenke deg å investere i?
15	Hvor mye ville du totalt investert i oppstartsselskaper/unoterte selskaper gjennom en slik plattform?
16	Hvor mye ville du typisk ønsket å investere per selskap?
17	Hvilken betalingsmodell ville passet deg best?
18	Hvor mye gebyr per transaksjon ville du vært villig til å betale på en slik plattform?
19	Hvor mye gebyr i prosent per transaksjon ville du vært villig til å betale på en slik plattform ?
	Demografiske spørsmål:
20	Kjønn
21	Alder
22	Jobbsituasjon
23	Årlig bruttoinntekt (inkluderer lønn og alle andre inntekter):
24	Investerbar formue (utenom primærbolig)
25	Andre kommentarer til undersøkelsen

C.2 Interview Guide for Angel Investors

	Generelle spørsmål
1	Hvor lenge har du drevet med investeringer i oppstartsselskaper?
2	Hva ser du etter i selskaper du investerer i?
3	Hvordan kommer du i kontakt med, og hvordan får du informasjon om oppstartsselskaper?
4	Hvor mange oppstartsselskaper har du investert i?
5	Hvor mye investerer du typisk per selskap?
6	Hvor mye har du totalt investert i slike selskaper?
7	Hvordan fører du oversikt over din portefølje av oppstartselskaper i dag?
8	Hvor mye tid/ressurser bruker du på å holde den oppdatert?
	Portefølje for aksjer i oppstartsselskaper
9	Har du et behov for en bedre løsning for å føre portefølje?
10	Hvilke funksjoner hadde vært ønskelig i en automatisk elektronisk porteføljeløsning?
	Skatteinsentivordningen
11	Kjenner du til skatteinsentivordningen?
12	Gjør skatteinsentivordningen det mer attraktivt for deg å investere i oppstartsselskaper?
	Markedsplass for aksjer i oppstartsselskaper
13	Ville du hatt behov for en plattform som gjorde det lettere å finne oppstartsselskaper å investere i?
14	Ville du investert mer i oppstartsselskaper hvis det fantes en plattform som gjorde det enkelt å kjøpe og selge aksjer i slike selskaper?
15	Synes du en markedsplass for unoterte aksjer i oppstartsselskaper er en god idè?
16	Ville kontinuerlig verdsettelse gjennom jevnlig omsetning av aksjer på markeds-plassen være ønskelig for deg? Samt det at det lager et likvid annenhåndsmarked?
17	Hvilken prismodell ville passet deg best?
18	Hvor mye kurtasje ville du vært villig til å betale på en slik plattform i gebyr per transaksjon?

19	Hvor mye kurtasje ville du vært villig til å betale på en slik plattform i prosent av transaksjoner?
	Startblock-as-a-Service
20	Ville det vært attraktivt å kunne delta å kunne gjennomføre hele generalforsamlingen elektronisk?
21	Ville det vært attraktivt å kunne avgi stemme elektronisk i en fysisk generalforsamling?
22	Hvordan stiller du deg til om en slik plattform tilbyr crowdfunding?
	Platform Architecture
23	Hvordan stiller du deg til om en slik plattform brukes av mange småsparere/ hobbyinvestorer? (Network effects)
24	Hvor store kostnader vil være å bytte system for å føre portefølje? (Switching costs)
	Chicken-and-egg problem
25	Hva tror du er de viktigste insentivene og utfordringene for følgende aktører mtp. å ta plattformen i bruk? a) Startups b) Engleinvestorer c) Småsparere

C.3 Interview Guide for Startups

	Generelle spørsmål
1	Antall aksjonærer?
2	Antall eksterne investorer?
3	Antall ganger dere har hentet inn kapital?
4	Hvor mye kapital hentet fra eksterne investorer?
5	Hvordan kommer dere i kontakt med investorer?
6	Hvilke investorer ønsker dere å ha?
	Cap Table / aksjeeierbok
7	Hvor mye tid/ressurser bruker dere på å holde aksjeeierboka oppdatert?
8	Har dere et behov for en bedre løsning for å føre aksjeeierbok? Og enklere rapportering til Altinn?

9	Hvilke funksjoner hadde vært ønskelig i en elektronisk aksjeeierbok?
	Skatteinsentivordningen
10	Kjenner du til skatteinsentivordningen?
11	Gjør skatteinsentivordningen dere mer attraktive for investorer?
	Markedsplass for aksjer i oppstartsselskaper
12	Ville du hatt behov for en plattform som gjorde det lettere å nå ut til investorer?
13	Hvordan ser dere på en eventuell omsetning av aksjer i selskapet?
14	Synes du en markedsplass for unoterte aksjer i oppstartsselskaper er en god idè?
15	Hvilken prismodell ville passet deg best?
16	Hvor mye kurtasje ville du vært villig til å betale på en slik plattform i gebyr per transaksjon?
17	Hvor mye kurtasje ville du vært villig til å betale på en slik plattform i prosent av transaksjoner?
	Startblock-as-a-Service
18	Ville det vært attraktivt å kunne delta å kunne gjennomføre hele generalforsamlingen elektronisk?
19	Ville det vært attraktivt å kunne avgi stemme elektronisk i en fysisk generalforsamling?
20	Har dere vurdert å gjøre en crowdfunding av aksjekapital?
21	Ville det vært attraktivt med en plattform som gjør det enklere å gjennomføre crowdfunding?
22	Er det behov for en plattform for å lettere nå ut med informasjon til og følge opp aksjonærene?
	Platform Architecture
23	Hvordan stiller du deg til om en slik plattform brukes av mange småsparere/ hobbyinvestorer? (Network effects)
24	Hvor store kostnader vil det være tilknyttet å bytte system for å føre aksjeeierbok? (Switching costs)

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