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Emerging Innovations in the Swedish Financial System

Investigating potential disruption

Master of Science Thesis
in the Management and Economics of Innovation Programme

ADAM ALBERTSSON
RICKARD WENDEBERG

Department of Technology Management and Economics
Division of Science, Technology & Society
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ADAM ALBERTSSON

RICKARD WENDEBERG

Tutor, Chalmers: Erik Bohlin

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Department of Technology Management and Economics
Division of Science, Technology and Society
Chalmers University of Technology
SE-412 96 Gothenburg, Sweden
Telephone + 46 (0)31-772 1000

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Adam Albertsson and Rickard Wendeberg

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ADAM ALBERTSSON
RICKARD WENDEBERG
Department of Technology Management and Economics
Chalmers University of Technology

Abstract

The Swedish financial system faces a potentially disruptive threat from emerging FinTech and ICT technology innovations. This research sought to investigate emerging innovations and how these relate to the Swedish financial system, in order to decide whether these could be considered disruptive or not for the Swedish financial system. By using an exploratory inductive methodology, a theoretical framework with a foundation of Disruptive Innovations combined with the Business Model Canvas, Rogers attributes of adoption, as well as institutions is used to get a thorough understanding of which kind of innovations that are adopted and why some of these are considered to be disruptive. This followed by a presentation of three emerging innovations; Peer-to-peer Marketplaces such as Peer-to-peer lending, Debt crowdfunding, Equity crowdfunding and Peer-to-peer currency exchange; the Blockchain Technology; and Internet of Things (IoT).

With the Swedish financial system in mind, the emerging innovations were analyzed separately with respect to the theoretical framework to decide their potential disruptiveness for the financial system. It was found that it might not be appropriate to define innovations as either disruptive or not, but rather that these are disruptive with respect to a specific firm, system or process in the financial system. Additionally, it was found that Peer-to-peer lending, Debt crowdfunding, Equity crowdfunding, as well as Usage-based insurance could not be considered disruptive innovations, but rather complements to traditional lending, funding, and risk calculating respectively. Furthermore, Peer-to-peer currency exchange and Blockchain Technology were considered being disruptive innovations. However, the banks and stock exchanges will probably disrupt themselves rather than being displaced. Instead, systems and organizations that risk getting obsolete due to the Blockchain are CLS, Bankgirot, Euroclear Sweden and INET Nordic. Similarly, Peer-to-peer currency exchange might force banks to update their obsolete business models for trading currencies.

Keywords: Disruptive, Innovation, Blockchain, Peer-to-peer, Internet of things, Business models, Adoption of innovation.

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1. Introduction

This chapter aims to provide the setting of the report by giving a background and the purpose of the study. Further, the delimitations and the report outline is presented to provide further understanding of the reasoning for the report.

1.1 Background

The financial system is of utmost importance for a well-functioning society. With the overall purpose of allocating savings, managing risk, and enabling payments it is also an industry highly susceptible to disruption (Godsiff et al., 2014). As for other industries, innovation in financial services allow for economic growth and the industry to meet society's evolving needs. However, after frequently having been introduced to innovations during the past decades, digital technologies that are threatening established actors and their business models are now emerging to possibly restructure the current competitive landscape (Bruno et al., 2014). The industry is facing a new wave of technological change from FinTech – an abbreviation of finance and technology – and Information and Communication Technology (ICT), which if adopted could be disrupting for established financial institutions and their services (Ventura et al., 2015).

There are various hyped FinTech and ICT innovations increasingly challenging functions in the financial system. Among the most prominent ones, there are peer-to-peer marketplaces for lending, funding, and currency transfer, individuals and businesses are allowed to borrow, raise capital, and exchange currencies without involving traditional financial intermediaries. The Blockchain, with benefits such as cheaper, faster and safer transactions is possibly replacing established financial infrastructure, and the effects of the technology seem to ripple into adjacent markets. Further, the Internet of Things is on top of the Gartner hype cycle. Building upon the increasing amount of physical interconnected objects that are able to collect and exchange data, it could allow for development of new business models within insurance based on personal data instead of traditional risk calculation models and standardized proxies.

Although diffusion and adoption of innovations does not happen overnight, the emerging FinTech and ICT trends are expected to grow rapidly with potential opportunities for governments, financial institutions, entrepreneurs and investors. Incumbents are however often inhibited by established thinking and the need of satisfying a mainstream market, which makes them vulnerable against new entrants that generally can make better use of radical innovations due to their flexibility (Ventura et al., 2015). In order to avoid being disrupted, incumbents must seek new ways of becoming more competitive; in-house development, new partnerships, or strategic acquisitions are a few of those options. Growth of innovations is however dependent on several enabling factors, such as the regulatory and business environment. That regulations are allowing new businesses to emerge and that entrepreneurship is supported through for example availability of technology and demand for innovative products, is important for innovation to flourish (Dutta et al., 2015).

Sweden provides one of the best environments for innovation globally (Dutta et al., 2015). The country provide a healthy environment for innovation in terms of regulations and ease of starting businesses. ICT infrastructure is excellent, and technology is affordable and widespread among businesses and individuals. Furthermore, Swedish companies are considered to be highly innovative, frequently coming up with new products and services (Dutta et al., 2015).

Considering that financial services currently are under a threat from emerging FinTech and ICT innovations, and that Sweden is one of the most technologically developed countries globally, this report aims to investigate whether disruption can be expected or not in the Swedish financial system.

1.2 Purpose and research questions

The purpose is to investigate emerging innovations and how these relate to the Swedish financial system, in order to decide whether these are disruptive or not for the Swedish financial system.

- How is the Swedish Financial System structured?
- What emerging innovations are there in the Swedish financial system?
- How do these relate to the Swedish financial system?
- Are these innovations disruptive for the Swedish financial system?

1.3 Delimitations

The report focuses on certain emerging innovations that was decided in conjunction with the supervisor. The reason for choosing these were that they were predicted to be influenceable in the financial sector and had a certain hype. The report focuses on only one sector, the financial system and its functions and markets, which also were decided in cooperation with the supervisor. Furthermore, it will only cover the financial system in Sweden and not the global. The report focus mainly on the impact of the technologies and their applicability in the financial system and will therefore not cover technical details of the technologies.

1.4 Report outline

Chapter 2 is the theoretical framework providing a foundation of the knowledge required to understand the concept of disruptive innovation, business models, adoption of innovation and the effect of institutional factors. Knowing the foundation of these concepts allow the reader to better understand the empirical findings, the analysis, and the following discussion.

Chapter 3 is the methodology for the study. It involves a description of how the research was conducted. It starts with a description of the research process where every step is explained. It then describes the strategy and the design that was used for this study. Finally the quality of the research is assessed followed by a discussion of the deficiencies of the method.

Chapter 4 is the start of the empirical part of the paper and it explain the Swedish financial system. It presents the functions, the markets, the intermediaries within those, the infrastructure that is used, as well as regulations for the intermediaries, which are necessary for being able to analyze the potential disruptiveness.

Chapter 5 presents three different business models of Peer-to-peer financial marketplaces; Peer-to-peer lending, Crowdfunding and Peer-to-peer currency exchange. The models and their impact on the financial system, their benefits and challenges, as well as their predicted future will be explained.

Chapter 6 involves a description of the IoT as one of the potentially disrupting innovations for the Swedish financial system. It is explained what it is, how it works, and in terms of application in financial services in order to understand the potential disruption from IoT. Further, potential challenges and future outlook are presented.

Chapter 7 describes the Blockchain Technology. It is explained from a technological point of view and in terms of applicability in the Swedish financial system. The potential challenges and risk with adopting will be covered, as well as the future outlook for the technology.

Chapter 8 contains an analysis for deciding whether incumbent firms as well as systems and infrastructures in the Swedish financial system face a potential disruption from emerging innovations. Initially, Peer-to-peer marketplaces is analyzed where Peer-to-peer lending and Debt crowdfunding have been separated from Peer-to-peer Foreign Currency exchange and Equity crowdfunding since some relevant factors for analyzing these differ. That is followed by an analysis of the Blockchain technology where payments, issuance and transaction of securities will be treated separately and lastly an analysis of Usage-based insurance will be performed. For the analysis, we have used a modification of the tool for identifying a firm's enemies presented by Rafii & Kampas (2002), influenced by the attributes of adoption, the business model canvas, institutions, and entry barriers. Starting out with the suggested steps and as many of the suggested factors as possible from the original model, we have added relevant factors, based on other theories from the theoretical framework, and removed irrelevant ones within each step. Further, we have rated and weighted each factor individually in order to be able to decide it's disruptiveness through discussion.

Chapter 9 involves a discussion, where the results from the analysis are combined with other theories regarding disruptive innovations and empirical data about the innovations, to find out whether the results from the analysis seems to be true and whether the innovations really are disruptive or not.

Chapter 10 consist of the conclusions from the entire report and present some suggestions for further research in the area.

2. Theoretical Framework

This chapter starts with an introduction to disruptive innovations and how the threat of those can be identified or even turned into business opportunities. It is followed by an explanation of business models and business model innovation and what attributes that decides whether an innovation gets adopted or not. Furthermore, an explanation of institutions and how these change over time will be covered as well as the main barriers for entering a market with a new innovation.

2.1 Disruptive innovation

In the book, The Innovator's Dilemma, Clayton Christensen (1997) writes about well-managed, successful companies that are getting replaced in a process where technologies that initially find adoption at the bottom of the market relentlessly become the dominant one. He calls such technologies *disruptive technologies* and presents findings of why industry leaders fail to withhold their number one position because of those. The companies have been replaced during certain types of market and technological change, even though they have been doing business as they were supposed to. He even states that "good management was the most powerful reason they failed to stay atop their industries", meaning that listening to customers, investing in technologies that these demand, and pursuing innovations that promise the best returns are the reasons for having to abdicate as industry leaders.

To further explain why these companies fail, Christensen (1997) makes a distinction between sustaining technologies and disruptive technologies. Technologies that give increased performance of existing products or services, are categorized as sustainable. He means that technological advances in most industries generally are of such nature and that these improvements are along the dimension of performance that customers in major markets historically have demanded. In contrast, disruptive technologies offer a very different value proposition. Christensen (1997) means that these technologies are generally underperforming in the mainstream market, but have features that are valuable to some customers in the existing market as well as a number of customers outside the main market, where the latter are perceived to be unattractive to incumbents. Other characteristics of disruptive technologies are that these generally are cheaper, simpler, smaller, and more convenient to use (Christensen et al., 2002).

A reason for incumbent failure is that technology performance generally develops faster than the market. Incumbents are continuously increasing the performance of existing products to earn higher margins and beat competition, until the technology finally overshoots the required performance. At the same time, as shown in figure 1, the performance of the disruptive technology improves and suddenly appears to be "good enough" to be competitive (Christensen, 1997).

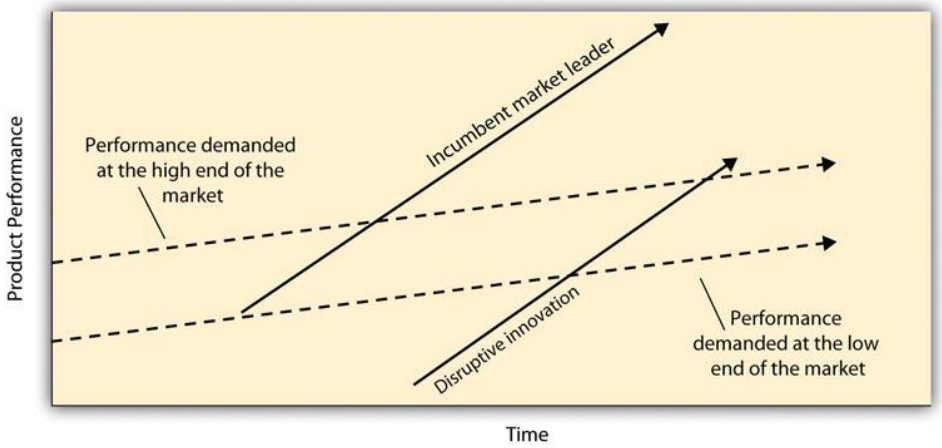

Figure 1. Technology overshooting (Christensen, 1997)

For established companies, it is not rational to invest in disruptive technologies (Christensen, 1997). Most companies tend to listen to their most profitable customers and develop products that are attractive to those. These customers generally do not demand products based on disruptive technologies, products that instead are embraced by less attractive customers in less profitable markets. Thus, Christensen (1997) means that incumbents are often too late when the products based on disruptive technologies eventually gain traction in the market, ultimately resulting in losing ground.

Christensen (1997) suggests a couple of actions that incumbent firms can take in order to exploit disruptive technologies instead of being replaced by them. Considering that most successful firms are dependent on what their customers and investors want, it is difficult for them to allocate resources for disruptive technologies. Therefore, Christensen (1997) suggests setting up an autonomous organization to be responsible for commercializing the disruptive technology. Such an organization would not have to be bound by the demands of mainstream customers and could instead focus on the emerging market.

Since Christensen formulated the term disruptive technologies he has widened the application to also involve products and business models – disruptive innovations.

2.1.1 Identifying the threat from disruptive innovation

To help companies avoid ending up in over-satisfying mainstream customers in existing markets, and by doing so risking to be disrupted according to the reasoning above, Christensen et al. (2002) have formulated guidelines to increase the understanding if there are conditions for disruption. They present that disruption either emerges through a new market, or through disrupting the business model from low end.

In order to understand whether there might be a disruptive threat emerging through a new market, Christensen et al. (2002) mean that companies should look for signs where customers are not able to use certain products or services because these are too expensive or too complicated. In that case, there might be an opportunity for creation of a new market where those customers' demands are satisfied. In such a market, the innovation target customers who in the past have not been able to use the product or service for one or more reasons, often due to lack of money or skills. If an innovation does not target customers outside the main market, Christensen et al. (2002) mean that it is more likely to be a sustainable innovation, serving existing customers rather than attracting new ones.

A potentially disrupting innovation emerging through a new market is generally attractive to customers who will welcome a simple product or service. Further, Christensen et al. (2002) mean that change does not happen quickly and that customers prefer doing what they are used to, rather than trying to do something that has not been a priority before. That an innovation helps customers to do what they are already trying to do more easily and effectively is therefore also an indication that the innovation is potentially disruptive.

There are however innovations that fit into an already existing market, possibly satisfying a number of customers asking for less performance than current products and services offer. These customers might be targets for a disruptive business model. For this to happen, current products or services must be more than good enough. If these are not, there is no point offering new ones with even lower performance (Christensen et al., 2002). If companies can justify price increases in a certain segment for additional improvements of their product or service, that segment is not yet over-served. However, if a segment is over-served and it is possible to create a different business model than the established one, it might be possible to disrupt the business model from low end. A disruptive business model is different from the current business structure and must be unattractive to other incumbents. It should allow for higher return on assets since margins can be expected to be lower at the low-end of the market (Christensen et al., 2002).

Christensen et al. (2007) summarize their thoughts of identifying disruptive competition into three pieces of advice. First, incumbents should look for relatively new competition offering similar but simpler and cheaper alternatives to customer segments that are not being targeted. Second, companies should see if products or services offered by this competitor are considered "good enough" even though these are simpler and cheaper. And third, incumbents should decide if the new competitor's business model is possible to scale up and if it could be sustained.

A tool for identifying disruption, building upon Christensen's theory, is presented by Rafii & Kampas (2002) in their article in Harvard Business Review. The purpose of the tool is to identify disruptive innovations before being destroyed.

2.1.1.1 How to identify your enemies before they destroy you

Rafii & Kampas (2002) presents a tool that might be useful for incumbents to identify disruptive innovations from new entrants, or what they call insurgents. By using the tool, incumbents can formulate strategies for preventing disruptive products and services or making them into business opportunities. It is also useful for the insurgents who can identify which approach that is the most beneficial for success (Rafii & Kampas, 2002).

The tool includes a disruption process consisting of six steps, each with various factors disabling or enabling disruption. The steps are (1) Foothold market entry, (2) Main market entry, (3) Customer attraction, (4) Customer switching, (5) Incumbent retaliation, and (6) Incumbent displacement. Rafii & Kampas (2002) add that the first step is however not always necessary since some products and services enter the main market directly, and that insurgents' products or services might be complements rather than substitutes.

The factors in each step are rated on a seven-point scale in terms of disruptiveness and weighted depending on their influence. A rating of -3 is *highly disabling of disruption* and +3 is *highly enabling of disruption*, and the weight ranges from 1 to 3 with an increasing influence. The disruptiveness in each stage is reflected in the stage score, which is calculated by dividing the average weighted score with the average weight (Rafii & Kampas, 2002).

Main market entry			
Contributing factors	**Rating** (–3 to +3) from rating sheet	**Weight** (1 to 3)	**Weighted score** (rating × weight)
presence of blocking patents by the incumbent	+2	1	+2
need for very large capital investment up front	–1	1	–1
poor access to suppliers and channels	+3	2	+6
Averages		**Average weight = 1.3**	**Average score = 2.3**
Stage score (normalized to range of –3 to +3 by dividing average score by average weight)			**1.8**

Figure 2: Rating and weighting the disruption (Rafii & Kampas, 2002)

Rafii & Kampas (2002) recommends using a group of six to ten people with diverse knowledge representing the whole company to come up with relevant factors for each step, and that rating and weighting of the factors should be performed individually. If there is disagreement within the group when comparing individual rankings and weights there might be insufficient information or lack of a clear definition of the factors. Consensus is needed before moving into interpreting the results.

Stage	Forces disabling disruption	−3	−2	−1	0	+1	+2	+3	Forces enabling disruption
Foothold market entry	unattractive foothold market(s)				not utilized				attractive foothold market(s)
Main market entry	high barriers to entry					Dell had easy access to suppliers, no costly sales force, and it outsourced many activities.			low barriers to entry
Customer attraction	low value added					Dell offered low cost, build to order, direct shipping, and good technical support.			high value added
Customer switching	high costs of switching					Dell's products were fully plug-compatible.			low costs of switching
Incumbent retaliation	low barriers to retaliation					Compaq had difficulty duplicating build-to-order process and shifting channels.			high barriers to retaliation
Incumbent displacement	low revenue displacement					Dell and Compaq product lines overlapped greatly.			high revenue displacement

Figure 3. Disruptiveness profile (Rafii & Kampas, 2002)

If there is one or more very strong disabling factors disruption is unlikely to occur (Rafii & Kampas, 2002). For example, a protective patent or an incumbent highly capable of retaliating would most likely prevent disruption. It is, however, important for the company using the tool to monitor these factors over time as these might change, resulting in a new competitive landscape with a different potential for disruption.

If factors are neither strongly enabling nor strongly disabling it is hard to determine whether there will be disruption or not (Rafii & Kampas, 2002). Depending on whether the core business seems threatened or not, companies should monitor the competitive landscape or take action; such as analyzing a potential threat more closely, starting internal development, or exploring partnerships with emerging players (Rafii & Kampas, 2002).

If a stage or factor seems highly uncertain, it might be useful to explore a couple of possible future scenarios (Rafii & Kampas, 2002). By assuming different disruptive ratings of uncertain factors and forming scenarios where the uncertain factors are either enabling or disabling for disruption, companies could better understand possible outcomes, thus preparing for them.

If no factors are disabling and one or more are strongly enabling, the organization should expect disruption and must take action (Rafii & Kampas, 2002). Incumbents could for example increase their presence in the foothold market or main market through acquisitions, internal initiatives, or partnerships.

Even though there are few other innovation theories that have been as recognized and built upon as Christensen's theory, there is some critique to his framework of incumbents being disrupted.

2.1.2 Additional views on disruptive innovations

Danneels (2004) questions Christensen's distinction between sustainable and disruptive technologies and discusses whether a specific technology can be disruptive, or if it would be more appropriate to talk about the "disruptiveness" from a specific firm's competitive perspective. He also believes that additional performance dimensions might be needed to get a better understanding of why customer

preferences are changing in favor of disruptive technologies. Additionally, Danneels (2004) questions that mainstream customers not initially value disruptive technologies and that disruptive technologies always emerge from lower performance.

Christensen (1997) suggests that incumbent firms are dependent on satisfying their mainstream customers and investors, thus are limited in allocating resources for developing potentially disruptive technologies. Danneels (2004), however, believes that it is not that obvious what makes incumbents fail or succeed in times of technological change. Tripsas (1997), with her study of the typesetter industry, suggests that it is the complementary assets that decides whether an incumbent survives a wave of technological change or not.

Christensen's recommendation that incumbents should create a separate organization to commercialize the disruptive technology is questioned by Cohan (2000), Danneels (2004), Iansiti et al. (2003), and Markides (2006) who believe that this might not be the best strategy. By doing so, incumbents might lose important synergies in terms of vital functions such as information sharing, branding, and customer service among others. Rothaermel (2001) suggests that getting access to resources through strategic alliances is one way for incumbents to succeed in times of technological change. Markides (2006) agrees, suggesting that incumbents could form strategic alliances with smaller firms in potentially disruptive markets, or perhaps acquire minority stakes in them to survive. By doing so, the incumbent would be able to further develop that company by feeding it with resources to scale up if that market would be ready for consolidation.

Furthermore, Markides (2006) suggests that technological, business model, and new-to-the-world product innovations cannot be treated as the same phenomena. Even though innovations within the three categories might disrupt incumbents, these have different disruptive effects on market competition and managerial implications. For example, Markides (2006) means that disruptive business models does not necessarily take over the majority of the market, in contrast to what Christensen (1997) state about disruptive innovations ultimately being dominant.

2.2 Business Models

The business model concept has been known a long time but it became more commonly used in the mid-1990s along with the internet expansion and the interest in the concept has exploded since then (Zott et al., 2011). According to Osterwalder & Pigneur (2013) "a business model describes the rationale of how an organization creates, delivers, and captures value". It should describe how the company entice customers to pay for the value and how it converts those payments into profit (Claesson, 2014). A business model can also be used as a competitive tool, offering the same products and services but in a new way, that is innovating the business model.

2.2.1 Business model innovation

Markides (2006) means that business model innovation is "the discovery of a fundamentally different business model in an existing business", and states that to be qualified as an innovation it has to yield

higher profits by either attracting new customers or increase consumption from existing ones. He means that "business model innovators do not discover new products or services", but rather redefine how to provide these to customers. Johnson et al. (2008) argue that there are certain times when it is necessary to change the business model in order to facilitate growth, for example when there is an opportunity to capitalize on a new technology by deliver it in a new business model. Björkdahl (2009) further argues that innovation in business models is important in order to appropriate value from new technologies and according to Calia et al. (2007) technological innovation can trigger business model innovation.

Technological innovation is important for a firm's success but it is no guarantee that a firm will be successful just because it has the best technology. The technology has no value in itself, it has to be embedded in a unique business model to capture the value (Zott et al., 2011). Chesbrough (2010) is of a similar opinion meaning that "a mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model".

In order to be able to compare business models and understand whether these are innovative or not, the building blocks of a business model will be explained according to Osterwalder & Pigneur's (2013) Business Model Canvas.

2.2.2 Business model canvas

Osterwalder & Pigneur developed a framework for describing, analyzing and designing business models, which is referred to as the "Business Model Canvas". It consists of nine building blocks that describes how a company expect to earn money. These blocks addresses four key areas; customers, value proposition, infrastructure and financials (Osterwalder et al., 2013), which can be compared to Johnson et al.'s four components. The Business Model Canvas consist of; customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure.

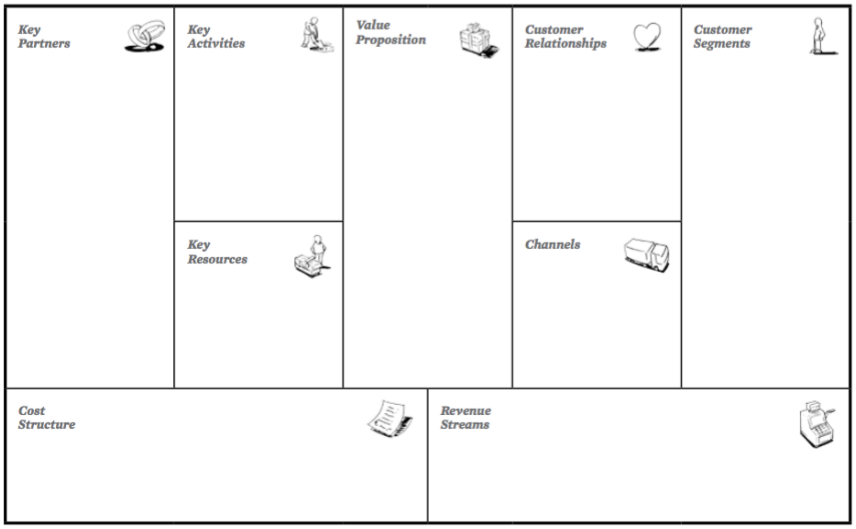

Figure 4. Business model canvas (Osterwalder & Pigneur, 2013)

The *customer segments* building block determines which customers a company plans to sell to and serve. In order to create an offer that satisfies customers' needs, it may be useful to segment them according to their common attributes. If the customer segmentation is carefully performed it will be easier to determine which customer needs to focus on and which to avoid (Osterwalder & Pigneur, 2013).

The *value proposition* includes the products and services that create value for the customers. A great value proposition satisfies a need or solves an important job for the customer, creates higher customer satisfaction than existing alternatives and delivers a better solution at a lower price than current solutions on the market (Johnson et al., 2008). Value propositions could be completely new and satisfy new needs, which is often the case when new technology is introduced. Moreover, a value proposition could improve performance, deliver a unique design or brand, reduce cost and risk or just offer a similar value at a lower price (Osterwalder & Pigneur, 2013). A key attribute of the value proposition is how well it gets the job done.

The *channels* describe how the value proposition is delivered to the customers and the communication between the company and its customers. Channels provide many functions such as; promoting a company's products and services, helping customers to analyze the value proposition, enabling customers to purchase products and services, providing a value proposition and delivering aftermarket services. The channels can classified as direct where they are targeted directly to the customers or indirect where they use intermediaries (Osterwalder & Pigneur, 2013).

The *customer relationship* block explains the different types of relationships that a company wants to establish with its customers. The relationships vary from relatively automated to very personal.

The *revenue streams* determines how the company earns revenues from its customers. It defines how much a customer is willing to pay for the value proposition and how these payments are carried out. The revenue streams comprise a revenue model, which is the strategy a company use to set a price in each customer segment (Osterwalder & Pigneur, 2013).

The *key resources* are the most essential assets that is needed to provide a value proposition to the customer (Osterwalder & Pigneur, 2013; Johnson et al., 2008) and these resources are one of the primary sources of profitability (Grant, 2010). The key resources vary between companies depending on their business and can be tangible, intangible or human (Grant, 2010).

The *key activities* are the most important actions that needs to be performed in order to implement the business model and create a value proposition. As for key resources, the key activities may be very different depending on the business (Osterwalder & Pigneur, 2013).

The *key-partnership* block describes the network of relations that is needed in order to provide a value proposition and make the business work. Partnerships are an important factor in many business

models and can help a firm to optimize resources and activities, generate economies of scale, reduce risk and uncertainty and acquire specific resources and activities. There are different kinds of partnerships and can be categorized into; strategic alliances, coopetition (strategic partnerships between competitors), joint ventures and buyer-supplier relationships (Osterwalder & Pigneur, 2008).

The *cost structure* involves all the costs associated with the eight former building blocks in the business model, the cost that are needed to run the business. The cost structure of a business model can broadly be divided into value-driven, which emphasize value creation, and cost-driven, which focus on minimizing the costs (Osterwalder & Pigneur, 2008).

The products and services that are created through innovations need to be adopted in order to create value. There are certain patterns for how innovations spread through social systems and gets adopted by different users. For a better understanding of why some innovations gets adopted or not, it is valuable to look further into individual perceptions of innovations and how these affect the rate of adoption.

2.3 Diffusion and adoption of innovations

One of the most recognized theories of diffusion comes from Everett Rogers (2010) and is described in his work Diffusion of Innovations. He means that even though an emerging technology has several advantages over an existing one, it is not necessarily adopted since the process of adoption is often very difficult and require a long period of time. Rogers (2010) describes diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system". He means that the most important elements of diffusion of innovation is the innovation itself, the channel through which the idea is communicated, the time it takes to be diffused, and in which kind of social system it is being diffused.

Rogers (2010) classifies the members of a social system depending on their *innovativeness*, which is defined as "the degree to which an individual is relatively early in adopting new ideas compared to other members of a system". The members of a social system can be classified into the categories innovators, early adopters, early majority, late majority and laggards, with decreasing innovativeness and acceptance for uncertainties of an innovation. Furthermore, Rogers (2003) presents five attributes that are related to the uncertainty of an innovation. He means that individuals' perception of these characteristics are useful for predicting an innovation's rate of adoption.

2.3.1 The attributes of innovation

The most important attribute is the *relative advantage* of an innovation, meaning "the degree to which an innovation is perceived as being better than the idea it supersedes", and it is often measured in economical profitability or social status (Rogers, 2003). From the economical point of view, an example could be to compare the initial investment to a potential cost reduction. In that case, the greater the cost reduction it would yield, the higher rate of adoption can be expected. Another reason

to an increased rate of adoption is that adopting a specific innovation would yield a higher social status (Rogers, 2003).

Compatibility is related to the consistency of past experience, values, and needs of the adopters (Rogers, 2003). If the compatibility is higher for the individuals in a social system, the uncertainties with adopting an innovation will be lower, thus the rate of adoption will be higher.

The *complexity* of an innovation is dependent on whether the individuals perceive the innovation to be difficult to understand and to use. Higher complexity implies lower rate of adoption (Rogers, 2003). It is important to understand that the perceived complexity is an individual measure, and that something that is perceived to be easy to use might be perceived as difficult for someone else.

Rogers (2003) explains the *trialability* as "the degree to which an innovation may be experimented with on a limited basis". He means that the rate of adoption will increase if individuals are able to test the innovation and identify the benefits for their specific situation since it would lower the uncertainties of adoption drastically. This attribute indicates that if an innovation can be designed in such a way that it can be tested easily, it would lower the time for the innovation-decision process (Rogers, 2003).

Finally, if the results from an innovation are clearly visible for the ones in the social system, then the *observability* is high, meaning a higher rate of adoption (Rogers, 2003).

It is apparent that there are a lot of complex interdependent individual relationships present in the diffusion and adoption of innovation. Individual preferences are highly important, the members of a social system tend to follow social rules and behave according to something called institutions.

2.4 Institutions - "the rules of the game"

In every social setting there are specific rules that affect how actors behave, which are referred to as *institutions* (Peng et al. 2006). Richard Scott (1995) defines institutions as "regulative, normative, and cognitive structures and activities that provide stability and meaning to social behavior". North (1990) explains this phenomenon by distinguish it into two categories, formal and informal institutions. Formal institutions are rules that humans devise and concern regulative factors such as laws, regulations and rules. In contrast to formal institutions, informal institutions are generally unwritten conventions and rules how to behave, which complement the formal rules. These include normative aspects like norms, and cognitive elements such as cultures and ethics. Peng et al. (2006) and North (1990) mean that institutions provide meaning and reduce uncertainty through defining the boundaries of legitimacy, but also affect cost of exchange and production. This means that institutions affect the performance of the economy (North 1990).

Degree of Formality (North, 1990)	Examples	Supportive Pillars (Scott, 1995)
Formal institutions	• Laws	• Regulative (coercive)
	• Regulations	
	• Rules	
Informal institutions	• Norms	• Normative
	• Cultures	• Cognitive
	• Ethics	

Figure 5. Institutions (Peng et al., 2006)

According to North (1990), institutions comprise constraints that people devise to shape the interaction between human beings and can either evolve over time or be created. Institutions affect which organizations that exist and how they evolve, but at the same time do organizations influence how institutions change over time.

2.4.1 Institutional change

Organizations exist to exploit opportunities in the society and as the organizations evolve they are able to change the institutions. The primary tasks of the institutions are to decrease uncertainty and create stability in the way people interact but they are constantly changing over time. The process of changing institutions is complicated and often occurs incrementally rather than discontinuous. North (1990) argue that incremental changes occur because entrepreneurs in economic and political organizations believe they could perform better by altering the existing institutions. Roland (2004) classifies institutions as slow-moving and fast-moving. The former changes slowly, continuously and incrementally while the other changes rapidly, discontinuously and in larger steps. Social norms and values change very slowly in general and are therefore classified as slow-moving institutions. Political institutions are examples of fast-moving institutions since these have the potential to change in large steps through centralized decisions (Roland, 2004).

Peters et al. (2005) argue that the triggers of change are both economic and political. However, their case studies show that political actors prioritize economic objectives higher than political. Furthermore, Peters et al. (2005) as well as Hagberg (2007) argue that institutional change is path dependent, which means that decisions in the past have a tendency to shape the current and future decisions (Sandström, 2015). It is always possible for individuals and organizations to change the path but it poses a risk that is generally perceived as high (Hagberg, 2007).

Although institutions could be barriers to entry a market, one can argue that business opportunities may emerge during institutional change. That would impose a threat of new entrants for incumbents.

2.5 Threat of new entrants and the barriers to enter a market

When new players enter an industry they have a wish to capture market shares, which challenges the costs, prices and investments in that industry. Therefore, the threat of new entrants limits the profit in the industry to a competitive level (Porter, 2008; Grant, 2010; McAfee et al, 2004). A high threat of entrants generates low prices or high investment for the incumbent firms, as they need to maintain their competitive position in the market. The size of the barriers to enter and the incumbent's expected retaliation determines the threat of entry in an industry (Porter, 2008). Porter (2008) further explains that if the barriers to entry are low and the expected retaliation on the entry from incumbent firms is low, the threat is high. According to Porter (2008) and Grant (2010) the most important sources of entry barriers are: economies of scale, network effects, capital requirements, cost advantage, product differentiation, access to distribution channels, switching costs and government policies.

Economies of scale arise when fixed costs can be spread over a larger amount of units, which gives lower cost per unit. It is very hard for new entrants to compete with incumbent firm with economies of scale; therefore this is a barrier for entering the industry (Grant, 2010). Network effects exist when the average value for a product or service increase for every additional customer. Capital requirements are the amount of investment that is needed in order to compete in the industry. If these are high it discourage players to enter the market (Porter, 2008). According to Grant (2010) established companies have the advantage of loyal customers and a strong brand, in an industry with product differentiation. Therefore, new entrants need to spend a lot more than incumbent firms in order to get the same brand awareness. The new entrants need to get access to distribution channels for its products or services. The more limited the channels are, the higher are the barriers and thus also the harder it is to enter the industry (Porter, 2008). Government policies can control entry into industries through restrictions, regulations or licensing requirements (Porter, 2008). Grant (2010) and Porter (2008) explains that governments can increase the barriers to entry through taxes and expensive patenting rules but also make it easier to enter through subsidies and funding of research.

3. Methodology

This chapter gives a description of how the research was conducted. It starts with a description of the research process where every step is explained. It then describes the strategy and the design that was used for this study. Finally the quality of the research is assessed followed by a discussion of the deficiencies of the method.

3.1 Research process

The research process presents an overview of how the study was carried out and consists of 10 steps, which were performed iteratively (figure 6). The research process was designed to provide an overview of what was to be done. Furthermore, it made it possible to plan and allocate the time for the research.

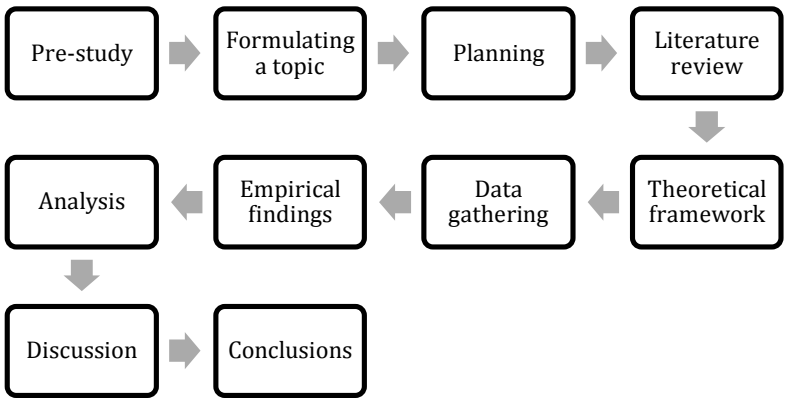

Figure 6. The research process

The first step in the research was to conduct a pre-study in order to get an understanding of the topic and analyze the feasibility of the thesis. The following step was to define the topic, which was done in cooperation with both the supervisor at 3gamma and at Chalmers. The third step in the process was planning of the thesis, which resulted in a brief planning report. This included a brief background of the topic, the financial system and 3gamma; the purpose of the study and initial research questions; as well as initial thoughts on which theory that could be useful.

For the literature review, references were gathered mainly through google scholar, but also through Chalmers student library and by investigating references in published articles, books. The literature review was done to determine what was already known and what theories and concepts that have been applied in the area of research. According to Bryman & Bell (2015) a useful way to demonstrate the credibility of the thesis is to link the research to existing literature. The literature review formed the foundation of the theoretical framework and made it easier to identify which empirical data that was relevant for the study. The empirical data gathered was mainly from consulting reports, articles, and blogs, but also from interviewing. The empirical data was then summarized into four chapters about the Swedish financial system, Internet of Things, Blockchain technology and Peer-to-peer marketplaces. These chapters, in combination with the theoretical framework, became the foundation for the analysis.

In order to arrive at a conclusion, the analysis of the study had to be discussed with respect to the theoretical framework and empirical findings. From the discussion, we were able to draw conclusions based on those.

3.2 Research strategy

According to Bryman & Bell (2007) it can be helpful to distinguish between two research strategies, a qualitative and a quantitative strategy. A general difference between these two strategies is that quantitative researchers uses measurements while qualitative researchers do not. Furthermore, Quantitative research strategies emphasize quantification in the gathering and analysis of data to find statistical correlations. Qualitative research strategies on the other hand uses words instead in the gathering and analysis of data to create a deeper understanding (Bryman & Bell, 2015). Creswell (2013) describes it in a similar way and states that qualitative researchers are making interpretations of the meaning of the data. He further explains a third mixed method, which is a combination of the quantitative and qualitative research strategy. All methods have weaknesses and a combination of both quantitative and qualitative data would neutralize the weaknesses from both (Creswell, 2013). The strategy of this thesis was qualitative since it aims at finding a deeper understanding rather than statistical correlations.

According to Saunders et al. (2012) an inductive approach means that the researcher explore data in order to develop theories from the data and subsequently relate these theories to the literature. An inductive method involves drawing conclusions from gathered data and empirical findings where the data collection often is done unconditionally (Wallén, 2008). Furthermore, the method gives an opportunity to draw general conclusions from the various tasks. This research is carried out in an exploratory manner where the gathered data is related to the literature and uses a qualitative strategy, hence, an inductive method is best suited.

3.3 Research design

A research design is a plan how to answer the research questions (Saunders et al., 2012; Krishnaswamy & Satyaprasad, 2010). Sreejesh et al. (2014) defines a research design as a blueprint or a framework for carrying out a business research project in an efficient way. They argue that a well prepared framework helps to lay the ground for the project and ensure that it is performed in an effective and efficient manner. They further explain that the most important aspect of a research design is to provide information so that potential problems can be analyzed.

3.3.1 Exploratory case study

The research design in this study was mainly exploratory, which is useful when the study seeks to find an understanding of a problem (Saunders et al., 2012; Sreejesh et al., 2014). This thesis seeks to understand emerging innovations, the Swedish financial system and explore whether these innovations are disruptive for the different parts of the financial system. Hence, an exploratory design seems to fit the research.

Bryman & Bell (2007) presents five different research designs; experimental, cross-sectional, longitudinal, case study and comparative. After examining these different designs, a case study seems to be the best design in order to answer the research questions and due to time and budget constraints. A case study implies an intensive and detailed analysis of a specific case and the researcher's objective is to provide a deep elucidation of it (Bryman & Bell, 2007). Robson (2002) explains that a case study involves an empirical investigation of a phenomenon in its real life context. Furthermore, a case study is suitable if the researcher seeks a rich understanding of the context and it has an ability to answer the questions "why?", "what?" and "how?" (Saunders et al., 2012). Since this thesis analyzes a specific case, emerging technologies applied in the financial system, and still emphasizes the context a case study is the best choice. Furthermore, the thesis is mainly exploratory, where case studies most often are used (Saunders et al., 2012).

3.3.2 Research methods for data collection

The data for this research has been mostly secondary, and has been gathered from academic papers, industry reports, consultancy reports, websites, articles and blog posts. Several sources has been used in order to confirm the information. To increase the understanding and validate the technological parts of IoT, an interview with IoT-Sverige has been made. The conducted interview were semi-structured in order to allow flexibility but at the same time ensure that the content of the interview is relevant to the research. To exploit the advantages of this technique and be able to lead the interview, it is essential that the interviewer possess necessary knowledge about the topic (Sreejesh et al., 2014). Therefore, the interview was conducted after gathering of secondary data, when the interviewers had gained more knowledge in the area. The use of multiple sources of data made it possible to triangulate, which increases the quality of the data (Saunders et al., 2012).

3.4 Research quality

Yin (2013) present four tests that are relevant to establish the quality of a case study research; Construct validity, internal validity, external validity and reliability. The construct validity, external validity and reliability tests were applied for this report. The internal validity is not applicable to exploratory or descriptive studies (Yin, 2013). Hence, it will not be addressed in this research.

3.4.1 Construct validity

Construct validity refers to what degree the measurement actually measure what you intended (Saunders et al., 2012). Sreejesh et al. (2014) defines it as to what extent measurement instruments represents and logically connects through the underlying theory. It measures why things happen rather than how they happen (Sreejesh et al., 2014). The construct validity of this research is believed to be relatively high since multiple sources of evidence and triangulation is used, which according to Yin (2013) is the first tactic to increase the construct validity. Another way to increase the construct validity is to maintain a chain of evidence, which could be established by allowing an external person to follow the evidence from initial research to the conclusions (Yin, 2013). In this study the supervisors were allowed and able to trace the evidence in any direction, which according to Yin's (2013) reasoning increases the construct validity.

3.4.2 External validity

External validity refers to the extent to which findings can be generalized beyond the study and across the social settings (Bryman & Bell, 2007; Yin, 2013). Generalizable means that the findings could be used in other research settings (Saunders et al., 2012). Since this research focuses on an industry rather than an organization, and could thereby be generalized across different parts of the industry, it is considered to have high external validity. Furthermore, the study focuses on different emerging innovations that are applicable in many settings, which further increases the external validity.

3.4.3 Reliability

Reliability refers to whether a later researcher, that conducts the same case study and follows the same structure, will be able arrive at the same findings and conclusions as the initial researcher (Yin, 2013). The research is reliable if the outcome is reproducible by using the same process (Sreejesh et al., 2014) and the objective is to reduce the errors in the study (Yin, 2013). In order to increase the reliability of the study every procedure needs to be documented (Yin, 2013). In this study every procedure has been documented. The methodology has thoroughly been written down, and the data sources have been referred to correctly, which thereby have increased the reliability of the research.

3.5 Criticism to the Research Methodology

As stated above, this study has been using mainly secondary data due to limited resources in terms of time and money, limited connections to interviewees and that there were a lot of secondary data available. One can argue that the research would have been better by using more primary data gathered through interviews but since there was a lot of high quality data available, it may have been a waste of time. However, it would be preferable to use more interviews in order to increase the understanding of the technologies. Furthermore, Saunders et al. (2012) argue that you have less control of the quality of secondary data. Hence, interviews could have been used to validate the secondary data. Furthermore, this study is based on a lot of data from consultancy reports, and their quality can be questioned since they often have a commercial purpose and may be used to attract clients.

Moreover, this research has a quite broad focus, it studies the entire financial system and several emerging innovation within many application areas. One can argue that it would have been more consistent if it had focused on one emerging innovation within the financial system instead of several. This might have resulted in a deeper analysis and maybe a greater contribution to academia.

The framework for analyzing the disruptive technologies should be used by six to ten people with diverse knowledge. Due to time and capital constraints it was not possible to gather that many people with dispersed knowledge, instead the analysis was carried out by the authors. One can argue that the analysis might have been different with the right amount of people with the required knowledge. Furthermore, the framework was developed to analyze the competition from disruptive technologies on company level. However in this research it has been modified, and complemented

with other theory, to analyze the innovations' impact on industries, systems, infrastructure as well as companies within the financial system.

Furthermore, much of the secondary data gathered is based on markets outside of Sweden. Although Sweden can be considered to have the great conditions for emerging innovations, there is a risk that some data might not be applicable for the Swedish financial system.

4. The Swedish Financial System

The Swedish financial system consists of four parts; (1) financial markets such as fixed-income-, equity- and foreign exchange market, (2) financial intermediaries such as banks and insurance companies, (3) financial infrastructure that consists of systems required to perform the activities in the markets, and (4) financial regulations in terms of rules and laws. This chapter contains an explanation of the main functions as well as the four parts of the Swedish financial system from Sveriges Riksbank's (2015) point of view.

4.1 The Swedish financial system's three functions

The Swedish financial system has three main functions; allocate savings into financing, manage risks, and enable payments (Riksbanken, 2015).

Individuals as well as businesses need to borrow money. Individuals might want to borrow money to buy a real estate, and companies might need capital in order to expand their business or acquire another company. Simultaneously, there are companies that want to invest their money and individuals who want to save for retirement. The task for the financial system is therefore to allocate the money from investors to borrowers in an efficient way (Riksbanken, 2015). This allocation of money can take place in the fixed-income market through financial intermediaries, such as banks, mortgage institutions or insurance companies. The intermediary values, monitors and manages credit risks of the companies and individuals to which they lend money. Though, sometimes it is more effective to turn directly to the market and issue securities and bonds on the equity market (Riksbanken, 2015).

Besides, allocating capital, the financial system also offers effective risk management. Financial intermediaries, as credit institutions such as banks, are experts in assessing credit risk. Individuals as well as companies need to hedge against different kinds of risks. Individuals might insure themselves from theft by buying property insurance or they might need to secure their livelihood after retirement or their family's livelihood in case of death by buying pension- or life insurance. Companies are more likely to insure against various financial risks. Hence, the financial markets offer various contracts to insure against such risks. These contracts are called derivatives and include options, futures and swaps (Riksbanken, 2015).

The third function is to enable efficient transactions between the parties in the financial system. Secure, fast and convenient payments is required in order for the economy to work. The financial infrastructure makes these transactions possible, which can occur between companies and individuals or between financial institutions. It further makes it possible for companies to offer their customers convenient payments in terms of credit cards, debit cards and bank account transfers, which facilitates exchange of goods and services (Riksbanken, 2015).

In order to carry out these three main functions, all four parts of the financial system are needed and the financial markets are a precondition for the capital to be allocated between investors and borrowers.

4.2 Financial markets

The financial markets in Sweden can be classified into three markets; the fixed-income market, equity market and foreign exchange market. The fixed-income market can in turn be categorized into a money market and a bond market, which is illustrated in figure 7. The fixed-income market and the equity market exist in order for companies, governments and individuals to get access to capital and at the same time help investors to invest their money. The foreign exchange market has the purpose of helping participants to buy and sell currencies.

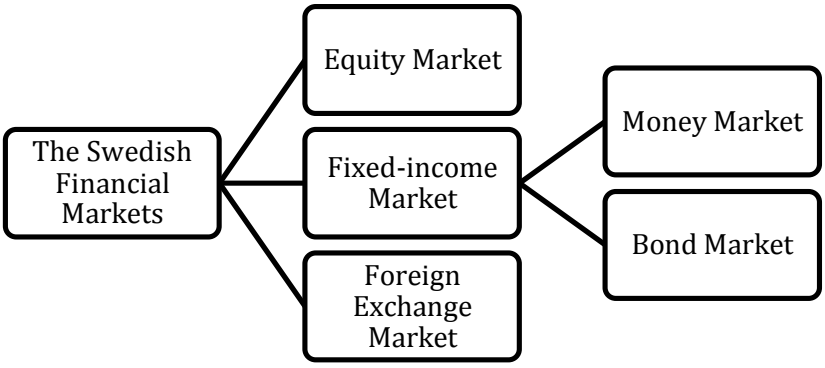

Figure 7. The Swedish financial markets.

4.2.1 The fixed-income market

The fixed-income market is used to trade so called debt instruments. The borrowers are issuing securities with different durations, for which they have to pay an interest. These borrowers are often governments, banks or companies that needs funding. The fixed-income market can be segmented into the money market and the bond market, where the first include debt instruments with maturities up to one year and the latter with maturities over a year. The bond market is used to allocate capital from savings to investments in the long term, where a bond is defined as "a debt instrument confirming an agreement to lend money that will subsequently be repaid with interest" (Riksbanken, 2015). The money market is used to allocate surplus capital and short term investments. Furthermore, it facilitates liquidity management and create stability by adjusting for surpluses and deficits in the participant's transactions accounts. The participants on the money- and bond market are mostly governments, banks, mortgage institutions, insurance companies and pension funds (Riksbanken, 2015).

The fixed-income market can also be segmented into a primary and a secondary market, where new securities are issued on the first one and can then be traded on the latter. The issuer of a security gets access to capital on the primary market and these securities might be sold on the secondary market (Riksbanken, 2015).

4.2.2 The equity market

Funding in terms of loans and bonds on the fixed-income market is often insufficient for companies that are in need of capital. They therefore often issue shares of their own company on the equity market to get access to capital. The stocks that are issued are initially sold to investors on the primary market, and the investors can then trade the stocks on the secondary market. The equity market, which is defined as "the trading in equity and equity-related instruments listed on Swedish marketplaces", is essential for facilitating allocation of capital from savings to investments (Riksbanken, 2015).

The equity market's marketplaces are categorized into regulated markets, also known as stock exchanges, and trading platforms, called Multilateral Trading Facilities (MTFs). There are two regulated marketplaces; Nasdaq OMX Stockholm and Nordic Growth Market, and three MTFs: First North Stockholm, Nordic MTF and Aktietorget. Nasdaq OMX Stockholm is the largest marketplace, where all trading is done through its members that include credit institutions and security companies (Riksbanken, 2015). Further, the regulated markets have stricter regulations and usually comprise larger and more established companies than MTFs. There are some admission requirements for companies to be listed on Nasdaq First North. There must be a sufficient number of shareholders and at least 10% of the share capital must be in public hands. Further, the companies must always have a certified adviser, accept the general terms and conditions for trading on Nasdaq First North, and follow the requirements regarding disclosure of information to the market. If those requirements are fulfilled, Nasdaq First North offer business valuation, marketing, and legal support (Nasdaq First North, 2015).

There are however several fees for listing on Nasdaq First North. There is an application fee of 82 000 SEK, an annual fee ranging from 73 000 SEK to 392 000 SEK depending on market capitalization. Moreover, there is a fee for a certified adviser of 50 000 SEK annually, as well as several one-time fees for corporate actions such as issuing of shares or other instruments (Nasdaq First North, 2016). Furthermore, for listing on Nasdaq OMX there is an entry fee ranging from 1 000 000 SEK to 1 900 000 SEK depending on the number of shares issued, and an annual fee ranging from 375 000 SEK to 1 300 000 SEK also depending on the number of shares issued (Nasdaq, 2016).

Trading at Nasdaq OMX Stockholm and Nasdaq First North is carried out in the trading system INET Nordic. Buyers and seller place their orders through their securities intermediary, which in turn hand them over to brokers who place them in the trading system's order book. The settlement after a deal is closed is handled by Euroclear Sweden, which makes sure that the ownership of the stocks is changed. The transaction of the stocks is finished when the payments are done, which usually takes three days and is handled by the seller's and buyer's banks (Riksbanken, 2015).

There is also a part of the equity market that separated from the stock exchange and MTF's. This is where private equity institutions, venture capital institutions, and business angels make investments

in unlisted companies and provide support in terms of funding, networks of contacts, and expertise etc. (SVCA, 2016).

4.2.3 The foreign exchange market

The foreign exchange market is the largest of the three markets in terms of turnover. The Swedish foreign exchange market can be defined as international trades with Swedish kronor as well as trades with foreign currencies carried out by Swedish institutions. There are several functions for trading currencies, such as matching receipts and payments in foreign currency. Another motive for trading currencies is to hedge against foreign exchange risks for which foreign exchange derivatives can be used (Riksbanken, 2015).

The instruments that are traded on the foreign exchange market can be segmented into spot and derivative instruments. A spot transaction means that the transaction, the payment and the delivery, is carried out directly. However, in reality this type of transaction takes about two banking days. The derivative instruments in the foreign exchange market has the function to manage risks (Riksbanken, 2015).

4.3 Financial intermediaries

The financial intermediaries in the Swedish financial system consists of *credit institutions*, *private equity investment- and venture capital firms*, *insurance companies*, as well as *securities institutions* (Riksbanken, 2015). In Sweden there are six major financial groups: Nordea, Svenska Handelsbanken, SEB, Swedbank, Danske Bank, and Skandia. It is common that several kinds of intermediaries are within the same financial group, either separately or through the bank.

4.3.1 Credit institutions

Banks and mortgage institutions are credit institutions with the purpose of providing a supply of credit (Riksbanken, 2015). Credit institutions are specialists in valuing, monitoring and managing the credit risk of the individuals and companies to whom they lend money. These institutions are heavily involved in transactions, providing bank accounts for payments and connects lenders to borrowers. By receiving deposits that can be used for payments, loans, or cash, they are able to contribute to the overall liquidity in the economy.

Banks represents the majority of lending to the public among Swedish credit institutes. These loans are the bank's assets and are represented on their balance sheet. It is therefore important for a bank that the lenders have high creditworthiness in order to avoid losses or credit risk, and thus being questioned by investors (Riksbanken, 2015). The investors are the ones who finance the banks with deposits. If they would mistrust a bank's financial strength, for example due to credit loss from lending, they could withdraw their deposits, meaning their financing of the bank. To avoid such liquidity problems from spreading to other banks, since they borrow capital from each other, there are regulations for banks to have a capital buffer.

The purpose of *mortgage institutions* is mainly to finance purchasing of property and homes. These constitute about 42% of the total lending of Swedish credit institutions (Riksbanken, 2015). The loans are often secured by legal charge on the property itself.

4.3.2 Private equity and venture capital institutions

Private equity and venture capital refers to the investment in unlisted companies with active owner involvement. Private equity and venture capital institutions differ from other financiers in terms of ownership and risk taking (Riksbanken, 2015). Venture capital investments are useful for new ventures considering that the risks related to new companies generally is high, making banks unwilling to grant them funding. Meanwhile venture capital institutions are focusing on ventures, private equity firms generally invest in more mature companies. These investments are called buy-out investments and are considered less risky than venture capital investments. The return of private equity and venture capital institutes depends on their ownership in the companies they have invested in, the portfolio companies, and how these develop.

4.3.3 Insurance companies

Insurers are not focused on the supply of capital, but instead rather on managing others' assets. Insurance companies are categorized as life insurance companies and property and casualty (P&C) insurance companies (Riksbanken, 2015). Life insurance companies offer compensation in cases of deaths, inability to work, and retirement meanwhile P&C insurance companies offer compensation for damaged property or for third-party damage. Life insurance can be seen as a kind of long-term saving in contrast to P&C insurance that is charged for with a price premium based on risk calculations and asset specific data.

4.3.4 Securities institutions

Securities companies and credit institutions, such as banks, with permission from Finansinspektionen to engage in trading of securities are called securities institutions. These act as brokers in the financial markets and their task is to manage commission trading. By allowing buyers and sellers to interact, and undertaking to buy and sell securities at specified prices all the time, these institutions ultimately create good conditions for liquidity in the market of securities (Riksbanken, 2015).

4.4. Financial infrastructure

The financial infrastructure is necessary for stability in the financial markets and among the financial intermediaries. It can be defined as "the systems which handle financial positions and/or enable financial flows between various participants, their legal frameworks and procedures and the participants' use of these systems" (Riksbanken, 2015). The financial infrastructure is a prerequisite for transactions between individuals and the financial intermediaries.

4.4.1 Different types of transactions

There are different types of transactions in the financial system, where the number of intermediaries range from none to several and they include funds, financial instruments as well foreign currencies.

4.4.1.1 Payments

There are different kinds of payments where the involvements of intermediaries range from no intermediaries to several. A payment without intermediaries occurs between a seller and a buyer, and the means of payment is usually cash. A payment with one intermediary is for example a bank transfer within the same bank. A payment like this, starts with the payer telling the bank to initiate the payment and transfer the money. Then the bank is carrying out the transaction from the payer's account to the recipient's account, and when it is done the payment is completed (Riksbanken, 2015). This scenario is illustrated in figure 8 below.

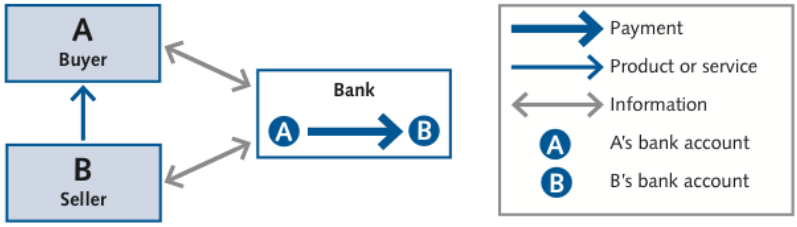

Figure 8. Payment with one intermediary (Riksbanken, 2015)

When the payer and recipient have their accounts at different banks there is a need to involve several intermediaries and systems to execute the payment, which is illustrated in figure 9. Hence, there is often a time lag in these kind of payments. Riksbanken (2015) explains the processes of a transaction between different banks in three steps. In the first step, the identities of the parties are verified and authorized, and the balance of payer's account is verified to make sure that the payer has enough funds to carry out the payment. In the second step, information and instructions of the transfer is compiled, which is referred to as clearing. It is carried out by a separate organization called a clearing house. The last step is settlement, which implies that the funds are transferred (Riksbanken, 2015). The banks have accounts at the national central bank, which is where the settlement takes place. Before the settlement, the bank's accounts in the settlement system at the national central bank are checked to make sure that there are enough funds for the transaction. In the settlement process, the payer's bank is debited, which in turn debit the payer's accounts, and the recipient's bank is credited, who then credits the recipient's account (Riksbanken, 2015). When these three steps are completed, the payment is completed and irrevocable.

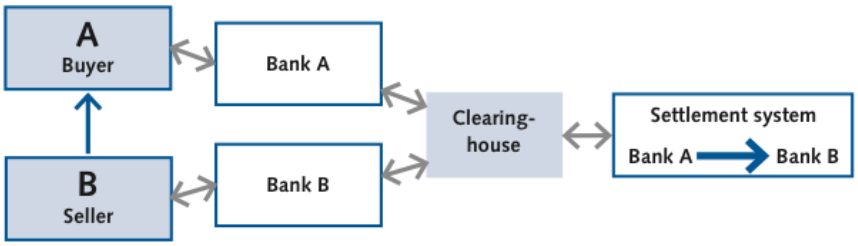

Figure 9. Payment with several intermediaries (Riksbanken, 2015)

In addition to payments between individuals, there are retail payments. These are, according to Riksbanken (2015), "payments of relatively small amounts that are made in a large number, most often between private individuals, companies and authorities". It is therefore payments between non-banks and comprise cash payments, card payments, direct debits and credit transfers.

4.4.1.2 Transaction of financial instruments

A transaction of shares or bonds requires almost the same infrastructure and processes as a payment with several intermediaries. However, a transaction of shares or bonds needs two flows: one for the funds and one for the transfer of the securities. This infrastructure is illustrated in figure 10 below.

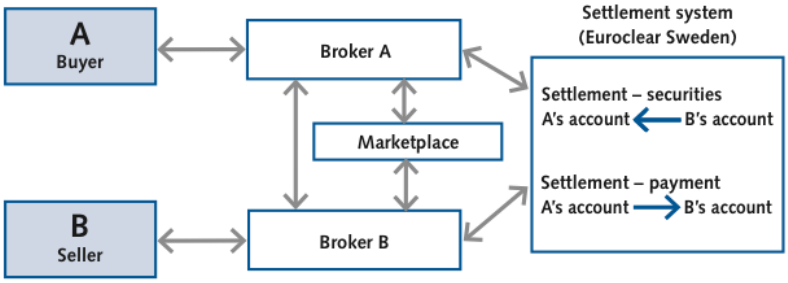

Figure 10. Transaction with financial instruments (Riksbanken, 2015)

A transaction of securities includes three steps. It starts with the seller and buyer placing their sell and buy orders in the marketplace. In the second step, the parties' records of securities transactions are checked in the settlement system, and the transfer instructions are then compiled. In the last step, the transaction is completed and the transfer of the securities and the funds are executed simultaneously, which is called Delivery versus Payment (DvP) (Riksbanken, 2015).

4.4.1.3 Foreign-exchange transactions

The foreign-exchange infrastructure is structured in the same way as the one for financial instruments, with two flows: one for each currency. Also in this type of transaction, the settlement carries counterparty risk, e.g. if the parties are in different time zones there is a risk that one party pay with a currency without being paid in the other. To solve this problem and decrease the counterparty risk there is a system in the infrastructure called *Continuous Linked Settlement* (CLS) that settles both currencies at the same time.

4.4.2 Systems in the Swedish financial infrastructure

The financial infrastructure is built upon a number of key systems that enable transactions between intermediaries and markets. The transactions are made directly in RIX or through one of the clearing systems: Euroclear Sweden, Nasdaq OMX Clearing, EuroCCP, Bankgirot or CLS.

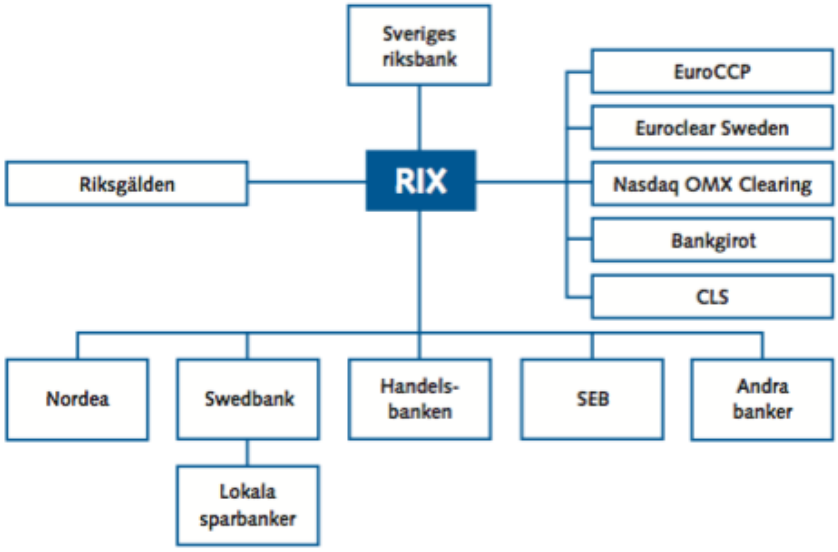

Figure 11. The Swedish payment system

RIX is the system for large-value payments owned and operated by Riksbanken. It can be seen as a hub in the financial infrastructure since all the large Swedish banks and clearing houses are connected to it, which is illustrated in figure 11. The banks have accounts in RIX that are used for direct payments as well as settlement of payment orders. The majority of all transactions from one bank to another and transactions of financial instruments are settled in RIX.

Bankgirot is a clearing organization for retail payments in Sweden, and it is owned by banks. It handles transactions such as bank giro payments, account transfers, payments that regulates cash management between the banks settlement of ATM withdrawals and card payments, as well as electronic invoicing and identification. Bankgirot's system collect information about size of the transactions and to what account they are being transferred and communicate it to the banks (Riksbanken, 2015).

Euroclear Sweden "registers and holds securities in accounts and settles transactions on the equity market and fixed income market" (Riksbanken, 2015). They have a central register of everybody's holdings, newly issued securities and trades of the securities in the Swedish markets. After a transaction of shares has been initiated by an investor that has placed an order at a bank and the bank has found a counterparty (or act as one themselves), Euroclear Sweden steps in to match buy and sell orders. Euroclear Sweden then verifies the bank's identity and that the counterparty agrees on the terms. They further verify that the seller has the security, that the buyer has the required

liquidity in its account. Then the securities and money is transferred and the transaction is completed. Transaction of financial instruments is usually of high value and it is therefore of great importance that the securities and the funds are transferred at the same time to reduce the counterparty risk. In order to minimize this kind of risk the settlement is done in central bank money, in accounts in RIX administered by Euroclear Sweden (Riksbanken, 2015).

Nasdaq Clearing is a central counterparty to transactions in share, commodity and interest rate derivatives as well as repos. Nasdaq Clearing thereby decreases the counterparty risk for all the parties by taking the risk themselves, i.e. the parties get a debt to or a claim on Nasdaq Clearing instead of each other. The payments that relate to a derivative contract is cleared in Nasdaq Clearing and then settled in RIX (Riksbanken, 2015).

EuroCCP is a central counterparty for Swedish equity trades, and thereby carries the counterparty risk that otherwise would be held by the seller and the buyer of the equity. EuroCCP clears the equity trade, which is then settled in Euroclear Sweden (Riksbanken, 2015).

Continuous Linked Settlement (CLS) was introduced to reduce the risk due to the time lag that occurs when a currency trade is made between two accounts in different countries. The banks involved in the transaction has one account for each currency at CLS, where the currencies are traded at the same time, so called Payment versus Payment (PvP). CLS has accounts at the parties' country's central bank. RIX is then used when the net balance of the member's transactions is either paid to or by CLS (Riksbanken, 2015).

4.5. Financial regulations

Financial intermediaries have to follow many rules and intermediaries in the Swedish market are dependent on decisions taken at EU level (Riksbanken, 2015). The financial intermediaries in the Swedish market are all affected by fundamental regulations on how they should be organized and managed. However, there are more specific regulations on how these intermediaries are supposed to perform their respective businesses.

4.5.1 Regulation for banks and credit market companies

All credit institutions are required to possess capital buffers beyond their capital needed for operations, (Riksbanken, 2015). This is realized through the *capital buffers act*. Further, to prevent criminal activities and financial operations from being used for illegal funding, there is the *act on measures against money laundering and terrorist financing*.

There are certain provisions for cancellation rights of credit agreements and repayments of debts in advance, and it is decided that banks and credit market companies are required to perform credit assessment, good lending practices and provide information for customers. These provisions are included in the *consumer credit act*. These institutions are also regulated under the deposit insurance act,

which is a state-provided guarantee of deposits in all types of accounts at banks, covering up to EUR 100 000 per customer.

A company receiving funds for dissemination of loans must get an approval from the Swedish financial supervisory authority in order to provide payment services and if they just disseminate the loans without receiving any funds they need to get permission to work as a consumer credit institution according to the *payment services act* (Finansinspektionen, 2015a).

4.5.2 Regulation for insurance business

There are two fundamental legislative blocks for private insurance operations. The first block is the *insurance business act*; which includes rules for establishment, operations, and supervision of insurers. For example, an insurance company is not allowed to perform both life- and non-life insurance, and insurers are required to possess capital beyond their commitments held. The relationship between the insurer and the policyholder is regulated by the second block: the *insurance contracts act*. Furthermore, there is the *insurance broking act*, which regulates how insurance are licensed and involves requirements that the insurers must follow (Riksbanken, 2015).

4.5.3 Regulation for financial markets

Regulations how securities institutions and clearing houses should be organized, the demands on their owners, and rules of conduct to protect their customers are included in the *Swedish securities market act*. It also describes the requirements of financial instruments that can be traded on a regulated market as well as rules of entry on such a market (Riksbanken, 2015). Additionally, it states that permission is required for trading with financial instruments (Finansinspektionen, 2015b). Furthermore, decisions on the recordings of ownership in accounts when securities have been traded are included in the *financial instruments accounts act*. Consumers are protected in the events of investment advice through the *financial advice to consumers act*.

5. Peer-to-peer Financial Marketplaces

In this chapter, three different business models of Peer-to-peer (P2P) financial marketplaces will be presented; P2P lending, crowdfunding and P2P currency exchange. The models and their impact on the financial system, their benefits and challenged, as well as their predicted future will be explained.

5.1 Introduction to Peer-to-peer financial marketplaces

P2P financial marketplaces occur in different models addressing individuals and businesses in all three of the Swedish financial markets. In the fixed-income market, *P2P lending* allow individuals to borrow money from each other as well as companies, while *Debt crowdfunding* provide businesses with an alternative source of funding. Both these models might eliminate the need of traditional financial institutions. Similarly, in the equity market, businesses are able to raise capital through *Equity crowdfunding* by issuing stocks to the crowd without the need of the stock exchange. Furthermore, *P2P currency exchange services* allow individuals to transfer currencies with each other without financial institutions' involvement. While many suggest that P2P lending and Debt crowdfunding are the same, for this report there is a distinction and P2P lending is defined as loans where individuals are the borrowers, and Debt crowdfunding as loans for businesses.

5.2 Peer-to-peer lending

P2P lending has got a lot of attention since it emerged in 2005 when Zopa, was founded in United Kingdom, but it was not until after the financial crisis in 2008 that it became an alternative to bank- and credit card loans (Renton, 2015; Mateescu, 2015; Becketti et al., 2015). The financial crisis forced the banks to review and regulate their lending activities, which resulted in that many small businesses and individuals found it much harder to get access to capital (Morgan Stanley, 2015; Renton, 2015; Becketti et al., 2015; Mateescu, 2015). When banks turned them down, many of these people got capital from credit card loans with much higher interest rates instead. Thereby, there was an opportunity for new types of loans without the traditional lending institutions with an interest rate between the banks and the credit cards. At the same time, investors were interested in alternative sources of yield due to years of low interest rates (Morgan Stanley, 2015). There are several providers of P2P lending platforms available in the Swedish fixed-income market, such as Lendify, Saveland, Sparlån AB, Moneybuddy and Bancaclub.

5.2.1 What is Peer-to-peer lending?

P2P lending implies that individuals are lending money directly to other individuals, through a platform, without a financial intermediary such as a bank (Renton, 2015; Segal, 2015; Mateescu, 2015). In traditional lending, the loans are represented as assets in the bank's balance sheet and they hold deposits as liabilities, which are insured by the government. Hence, the depositors money (up to 100 000 euro) will be repaid by the government in case the bank cannot do it themselves. In P2P lending, there is a marketplace that matches the investors and lenders, where the investors have the responsibility of their investments and thereby bears all the risks, i.e. there is no deposit insurance. The marketplace do not lend their own funds and do not need to bear the loans and deposits in their

own balance sheet, as for a bank, they just underwrites and services the loans, for which they charge a fee (Becketti et al., 2015).

Lendify is an example of how P2P loans work in the Swedish fixed income market. They act as a matchmaker who manage the administrative lending process, such as review of loan applications, establishment of agreements and administration of payments. To be able to loan, the borrower has to create an account and identify herself through her bank. Then she can apply for a loan where the application should contain the amount, the lending period and what the loan will be used for. The minimum requirements in order to apply for a loan is that the borrower has no payment defaults, no debt at the enforcement authority and a yearly income of at least 150 000 SEK. Before the application can be published, Lendify evaluates the creditworthiness and determines a credit rating for the borrower. There are five different credit ratings, ranging from A to E, which in conjunction with the duration of the loan determines the interest rate. This process takes approximately less than 2 hours (Lendify, 2016).

If the borrower is satisfied with the interest rate she can publish the application, and it is thereby possible for investors to see it and invest in it. The loan can be financed by one or many investors, where the latter is most common since investors want to spread their risks by financing several borrowers at the same time with amounts as small as 200 SEK. When the loan is completely financed, it is paid out and Lendify charges the lender a fee of 0.95 to 5 percent of the loan amount, depending on the lender's credit rating. The loan plus interest is repaid monthly until the loan is fully repaid, and in this monthly payment the investor is charged a fee of 0.5 to 1.5 percent (Lendify, 2016).

5.2.2 The benefits for borrowers, investors as well as the Peer-to-peer platforms

P2P lending target customers who could not get a traditional bank loan and who are not willing to pay the high interest rates of credit card loans. P2P lending gives increased customer satisfaction because of faster response times, simplified application process and quicker loan approvals and funding, which are major reasons for the growth of the new business model (Morgan Stanley, 2015). At the same time as borrowers' get access to funds, the investors get a higher rate of return on their invested capital compared to other lending alternatives and they can flexibly choose their level of risk by investing in loans with a specific credit rating and thereby risk of default. The average rate of return on the investment was approximately 7 percent for investments on Lendify's platform during 2015 (Lendify, 2016). The same numbers for Saveland was 10 to 15 percent per year (Saveland, 2016). The platform providers highlight that the risk is relatively higher and emphasize that investors should diversify their investment portfolio by investing small amounts in various loans with different risk and rate of return (Renton, 2015).

The P2P platform providers' main benefit is that they do not have the same requirements for liquidity and capital as the incumbent financial institutions. Moreover, they have lower operating costs and they earn their revenues from fees, paid by borrowers and lenders, for distributing the

loans (Morgan Stanley, 2015). However, to be able to offer P2P loans you need to be approved by the Swedish financial supervisory authority (Finansinspektionen, 2015).

5.3 Debt and Equity crowdfunding

Smaller firms and new ventures often experience a lack capital due to limited or not yet existing cash flows. In order to expand, these will soon or later generally have to attract external sources of capital to finance their growth (Schwienbacher & Larralde, 2010; Mollick, 2014; Belleflamme et al., 2014). Only a few ventures succeed in raising capital at a reasonable cost from venture capitalists since these generally demand a high stake in the company. Additionally, debt financing is often inaccessible for ventures and smaller firms since these generally are perceived as too risky for the banks (Schwienbacher & Larralde, 2010).

However, crowdfunding has proven to be a valuable alternative for accessing funds (Schwienbacher & Larralde, 2010; Belleflamme et al., 2014; Mollick, 2014). A number of Internet-based platform have become prevalent and crowdfunding as a source of capital has grown exponentially in later years (Bradford, 2012).

5.3.1 What is crowdfunding?

Schwienbacher and Larralde (2010) define it as "an open call, essentially through the internet, for the provision of financial resources either in form of donations or in exchange for some form of reward and/or voting rights in order to support initiatives for specific purposes". Mollick (2014) argues that the definition is too broad, instead he refers to crowdfunding as "the efforts by entrepreneurial individuals and groups – cultural, social, and for-profit – to fund their ventures by drawing on relatively small contributions from a relatively large number of individuals using the internet, without standard financial intermediaries". Put it simple, crowdfunding is an alternative way of sourcing capital, making use of small contributions from a large amount of people instead of traditional investors, to realize ideas requiring support in terms of funding or expertise.

There are different types of crowdfunding categorized depending on the contribution model for support of a business. Contributions could be pure donations, in exchange for some kind of reward, a pre-purchase of a product, a loan, or in exchange for equity (Belleflamme et al., 2014).

Crowdfunding based on a *donation model* is basically gathering donations where contributors can expect nothing in return. The *reward model* attracts investments through offering some kind of reward. The *pre-purchase* model is quite similar; in exchange for investments, the contributors receive the product that the venture is trying to create. These contribution models do, however, not affect the current Swedish financial markets significantly.

The *lending model* for crowdfunding is very similar to P2P lending but as stated above, it concern loans for businesses instead of individuals. Contributors provide temporary funds, which they expect to get back with interest. Finally, the *equity model* offer investors shares in the venture, and is the model that

most obviously involves the sale of a security (Bradford, 2012). In Sweden, the most prominent firms in crowdfunding are Toborrow offering crowdfunding through a lending model, FundedByMe through both a lending- and equity model, and Crowdcube through a pure equity model. All emphasizing the importance of diversifying for investors due to the high risk with investing in small and emerging businesses. The platform providers are also eager to show real world examples of successful investments to attract borrowers and investors.

On the Toborrow platform, requirements for approval as a borrower are a turnover above 1 000 000 SEK, a "well working business", and at least one financial statement available to decide creditworthiness. Approved borrowers can apply for loans and investors can contribute with investments to an interest- and amortization rate they choose themselves. The loan is handled as an auction, where the borrower either chooses the investors who bid with the most beneficial payback requirements, or chooses to reject the loan. This means that if the funding requirements are met, only the investors offering the lowest interest rate and amortization demands, might participate in the lending. Toborrow takes a fee between 2-4% of the total amount borrowed depending on payback period (Toborrow, 2016).

The FundedByMe platform slightly differs. Borrowers can either apply for loans to an interest rate they set by themselves, or apply for investments in exchange for ownership in the company. A fee of €1000 is charged when an equity based campaign goes live and the entrepreneur is charged 8% of the total amount gathered through the campaign. For a loan based campaign there is an initial fee of €1000 when the campaign goes live and the entrepreneur is charged 4% of the total amount gathered, and 1% for an additional administration fee for repayments to investors (FundedByMe, 2016).

Crowdcube target young ventures and offers equity-based crowdfunding. There is a one-time fee of 12 500 SEK, and if the funding target is met, they charge an additional fee of 12 500 SEK and take 5% of the invested capital. For this, Crowdcube use a separate brokerage house that handles the administrative tasks such as the formalities with the Companies Registration Office and Värdepapperscentralen, as well as allocation of shares and payments. There is a separate fee for these services, which is paid by the entrepreneur (Crowdcube, 2016).

5.3.2 How does it benefit borrowers, investors and Crowdfunding platforms?

Crowdfunding is valuable for companies in need of financial support since it is alternative to get funding without traditional financial intermediaries. As Bradford (2012) states; "anyone who can convince the public he has a good business idea can become an entrepreneur, and anyone with a few dollars to spend can become an investor". Furthermore, in addition to "just" getting access to funding, crowdfunding could be used for testing if business ideas are valid and for marketing (Mollick, 2014; Schwienbacher & Larralde, 2010). Announcing on a crowdfunding platform allows an entrepreneur to understand the demand of his or hers idea in a kind of "fail early" manner. Further, showing proof of an amount of customers wanting to fund a business idea could be

convincing for established financial institutions (Mollick, 2014). From the investor's point of view, crowdfunding provides a marketplace for investments in addition to the traditional stock exchange, but whether returns are higher or lower depends on each and every venture and it is up to the investor to decide.

Crowdfunding is emerging and is becoming an increasingly accepted alternative for getting access to funding. Further, Paradox is an example of a company that chose to issue a part of their total shares on an Equity crowdfunding platform and the rest on the stock exchange through Avanza (Pepins.com, 2016). They had a total listing cost of 3.5 M SEK, which can be compared to a usual cost of 30 to 40 M SEK for companies of this size (Bornold & Benson, 2016). In the case of new ventures however, Mollick (2014) argues that crowdfunding generally cannot provide the advice and governance that traditional early investors can.

5.4 Peer-to-peer currency exchange

Sending money over national borders usually takes a couple of days and comes with high transaction fees due to the need of processing between several intermediaries such as clearing houses and banks. The deal is often perceived to be unfavorable, senders can expect to be charged more than 5% of the money transferred when including commissions and the bid-ask spreads (Picardo, 2016). Traditional foreign exchange and its high margins seems, however, vulnerable to new actors with alternative business models (Ram, 2015). In the foreign exchange market where banks clearly has been the dominant actor, a new solution for sending money over national borders have emerged, that is P2P currency exchange.

5.4.1 What is Peer-to-peer currency exchange?

Put it simple, P2P platforms for currency exchange allow people to exchange currencies with each other (Picardo, 2016). Having to register an online account and deposit money into it (Bajpai, 2016), users are allowed to anonymously buy and sell currencies to much smaller fees than from using the traditional procedure including banks and brokers (Phillips, 2014). Depending on platform provider, exchange rates are pre-set or decided by bidding between the users (Bajpai, 2016). The platform makes a match between users and change the ownership of currencies in their respective online accounts (Bajpai, 2016).

Since the business model is based on individuals wanting to trade their respective currency with each other, there might be an unbalanced supply and demand of currencies. Beverley Traynor, at the established exchange provider Ebury, states that P2P currency exchange platforms, in contrast to established players, are not able to provide neither advice nor rare currencies (Ram, 2015). However, Phillips (2014) means that the platform providers in such situations would be able to do an exchange themselves to provide liquidity, and compensate for this with an additional fee. Bajpai (2016) argues that "the P2P currency exchange marketplace does not fully protect the customers", and recommend that users should avoid unregulated firms. Some of the most prominent P2P currency exchange

providers are Transferwise and CurrencyFair, providing similar services, both approved with respect to financial regulations.

Through an online account at Transferwise, customers deposit the currency they want to trade and select which currency they would like to get in return. The platform then matches the request with someone who need the opposite currency. In contrast to banks, who set their own exchange rate, Transferwise uses the so-called mid-market rate, which is the midpoint between supply and demand for a currency and by charging a 0.5% fee of the money transferred for their services, they claim that customers can save up to 90% compared to a traditional transfer (Transferwise, 2016).

The process of depositing and transferring involves three steps and the time it takes depends on the currencies and the method of payment, but generally takes 1-4 working days. It starts with a transfer of money to the Transferwise account, which can be done in several ways, such as with debit/credit card (immediate transfer), banks transfer (takes up to 3 working days), SWIFT transfer (generally takes up to 4 working days), SOFORT (takes 1-2 working days) and wire transfer (takes up to one working day). The second step involves the exchange of money, which usually takes a couple of hours but can take up to two working days. The last step is to send the converted money, which can be expected to reach the chosen bank account in a few working days depending on the currency (Transferwise, 2016).

Instead of using the mid-market rate, CurrencyFair are offering a marketplace for buyers and sellers, where the exchange rate is decided by the users. They charge a fixed fee of £3 and 0.15% fee of the money transferred for their service. However, they charge a 0.5% fee if they have to match a specific request in case there are no customers providing a competitive exchange rate (CurrencyFair, 2016). CurrencyFair (2016) state that customers on average pay £0.35 and argue that one can save up to 90 percent by using their service compared to traditional banks.

	Typical Bank	CurrencyFair
Transfer amount	£2000	£2000
International transfer fee	£40	£2,50
Exchange rate margin	£60	£6
Total cost of transaction	**£100**	**£8,50**

Figure 12. Cost comparison between a typical bank and CurrencyFair (CurrencyFair, 2016)

Using Transferwise and CurrencyFair as case examples, shows that using the mid-market rate as well as letting the users set the rate themselves are cheaper alternatives than the traditional transfer of currency across borders.

5.4.2 How does Peer-to-peer currency exchange benefit customers?

The main advantages for buyers and sellers of currency using a P2P currency exchange platform are that it is cheaper and generally faster than using the traditional international banking payment system (SWIFT) (Phillips, 2014). Baipaj (2016) also emphasize the cost savings as the main advantage allowing individuals and smaller businesses a cheaper, more convenient, but also generally faster transfer of currency.

7.5 The future of peer-to-peer marketplaces

P2P lending and various types of crowdfunding are included in the alternative finance category, which has had an average growth rate of 115% annually between 2012 and 2014 (Wardrop et al., 2015). P2P lending and Debt crowdfunding are the biggest in terms of funds raised, with average annual growth rates of 90% and 58% 2012-2014 respectively. Although smaller in terms of funds raised, Equity crowdfunding has experienced a significant average annual growth rate of 1389% between 2012 and 2014 (Wardrop et al., 2015).

The P2P lending model is expanding from consumer loans to other kind of loans such as mortgages (Hernandez et al., 2015). As stated before, P2P loans initially addressed consumer loans that were not attractive enough for traditional financial institutions and that was not included in the bank's core business offering. However, Hernandez et al. (2015) argue that an expansion into other product categories could be a threat to banks existing offerings and customer bases. Morgan Stanley (2015) argues that the future regulations might be a challenge for the platform providers, since the financial rule makers tries to catch up with the latest technologies. Furthermore, it is uncertain how this type of lending model can handle a possible financial crisis in the future, since it has not been tested in any similar context yet (Morgan Stanley, 2015).

The adoption of P2P lending platforms has taken off, and there are many available providers on the Swedish fixed income market. The global market for P2P lending has grown rapidly in recent years and Morgan Stanley (2015) expect it to reach $290 Billion by 2020, as can be seen in figure 13.

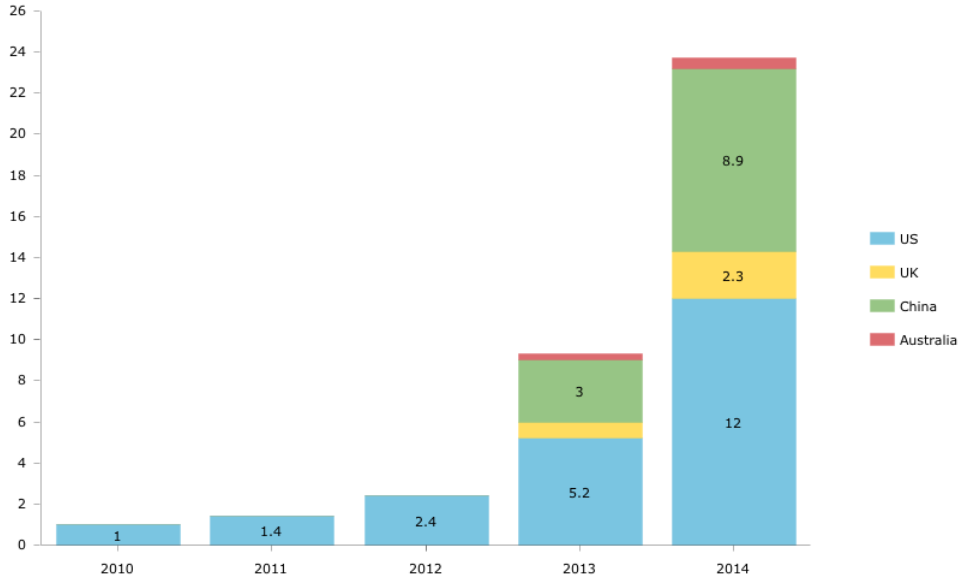

Figure 13. Global marketplace loan issuance in $billions (Morgan Stanley, 2015)

However, in the US market it is mainly the young part of the population that has adopted the P2P lending model. The use of this alternative loan model is greatest in the ages of 18 to 34 and the use gradually decreases among older people, according to Morgan Stanley's (2015) research, which is can be seen in figure 14.

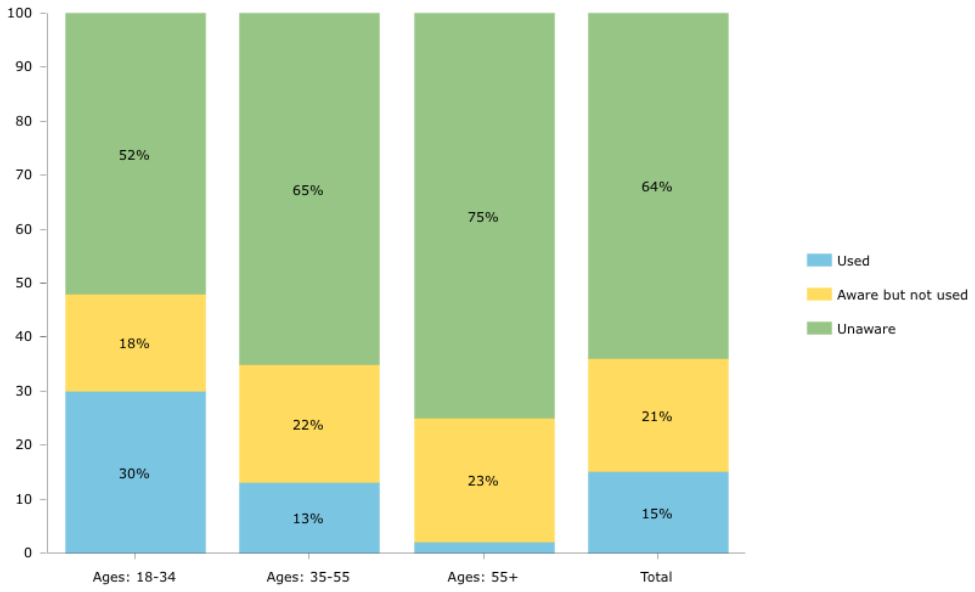

Figure 14. P2P lender awareness and use by age (Morgan Stanley, 2015)

Crowdfunding is still in its early stages but the platforms are considered to be sufficient in order to solve the financing problem that many businesses are facing (Shingles & Trichel, 2014). It is a growing alternative to traditional funding, which is predicted to reach $60 billion globally in 2016 and exceed traditional forms of financing (Hogue, 2015). Also The European Alternative Finance Benchmarking Report 2015, predicts it to increase in 2016 and get more funding than the $50 billion traditional Venture Capital market (Nordic Startup Bits, 2015; Hogue, 2015). Furthermore, the World Bank predicts it to be a $90 billion market by 2020, which they argue can be reached already in 2017 if the current growth rate continues. The European Alternative Finance Benchmarking Report 2015, on the other side, predicts the market to reach €83 billion in 2025 (Nordic Startup Bits, 2015). However, it has potential to replace Venture Capital and Angel Investing as well as many functions within the banks (Dawson, 2014).

Francois Petavy, CEO of Eyeka, predicts that Crowdfunding will step out of the experimental early stage and turn into a standard business practice. He further predicts that the industry will consolidate in the future. The Crowdfunding industry is characterized by network effects, which increase exponentially with the size of the company, and the companies need a critical mass to carry out the business, which in combination with a growing maturity will impose consolidation (Crowdsourcing, 2014). Hogue (2015) argue for a consolidated market as well and states that when the growth is slowing down, investors might want to sell their investments and venture capitalists and angels will acquire unprofitable platforms and integrate into their owns.

Venture capitalists has generally been investing in technological companies since these often had a high growth and return on investment. However, Crowdfunding has potential to in the future facilitate financing for industries that in the past have had difficulties to get access to funding, such as energy, sports, biotech and transportation (Miller, 2016). However, Miller (2016) argues that this scenario will not affect the tech companies' chances to get funded and predicts that more tech companies will pursue Equity crowdfunding in 2016. Luke Lang, co-founder of Crowdcube, presents his thoughts regarding Crowdfunding in 2016 (Entrepreneur & Investor, 2016). He predicts that the crowd will become even smarter, the investment will get bigger, crowdfunding will become a more mainstream financing alternative and will be able to be combined with other sources of funding and finally, that there will be partnerships between Crowdfunding platforms, traditional financial institutions and major brands.

Mantel (2015) means that as of today P2P currency exchange companies cannot outcompete traditional money transferring, and that these platforms combined do not even stand for 5% of the total money transferring market. However, he states that the current business models of banks are becoming obsolete and that "peer-to-peer services will eventually dominate the market for the benefit of us all". They have a proven business model that is scalable.

Paul Golden (2015) has summarized several thoughts of the future development of P2P within foreign currency exchange from leading individuals at P2P platforms as well as incumbent firms. Andrew Burley at Ebury is convinced that leading global banks play an important role in foreign

exchange in the future even though there is a threat from emerging P2P platforms. Brad Lemkus at Midpoint states that banks most likely will resist being replaced by such platforms, considering that foreign exchange is an important revenue stream for them. Dmitri Galinov at FastMatch agrees, and argues that banks most likely will offer access to P2P currency exchange platforms themselves due to the pressure from emerging cheaper and more customer friendly alternatives. Daniel Abrahams at CurrencyTransfer means that banks will always play a part of foreign exchange since these have established trust over many years, but that banks "must become less opaque and more fair when offering global currency transfer services" in order to stay competitive (Golden, 2015).

6. Blockchain Technology

In the following sections the Blockchain technology will be explained from a technological point of view and in terms of applicability in the Swedish financial system. The potential challenges and risk with adopting will be covered, as well as the future outlook for the technology.

6.1 What is Blockchain technology?

A major IT innovation known as Blockchain was invented in 2009 as the main technology behind the cryptocurrency, Bitcoin. At that time focus was directed at the new cryptocurrency, but in recent years the technology which it is built upon has attracted increasing attention. It has been realized that the Blockchain, as a distributed ledger, has more potential than just enabling transactions with bitcoins. Frøystad & Holm (2015) states that it has potential to be a disruptive technology for the financial system. The incumbent players are facing a decision; to disrupt themselves or risk that someone else does it to them (Cuomo, 2016). Hence many startups as well as incumbents in the financial sector are racing to develop solutions that exploit the potential of the technology (Frøystad & Holm, 2015).

According to Buehler et al. (2015) "a Blockchain is a cryptographic, or encoded, ledger comprising a digital log of transactions across a public or private network". Rosenberg (2015) describes it as "a distributed method of tracking and transferring assets online without need of a trusted third party". The first and most known application of the Blockchain is in Bitcoin, which is a cryptocurrency that is completely independent of states, banks and other institutions (Segendorf, 2014). In this application the Blockchain verifies all transactions that have ever been made and saves them in a ledger. Copies of the ledger are validated and distributed by a consensus process and several independent users verify that changes in the ledger are valid. Before cryptocurrencies, it was impossible to transfer value to a distant destination without a third party, due to the "double spend problem", which means that digital information easily can be copied and spent twice (Swan, 2015). This implies that a sender of digital money could send a copy and keep the original. A third party, for example a bank, is regularly used to keep track of the transactions. However, via a Blockchain-based transfers, the transaction is done directly between two parties and the responsibility for keeping track of the transaction is distributed over the whole network, which eliminates the need for an intermediary (Nakamoto, 2008). Hence, it is seen as "one of the most disruptive innovations since the advent of the Internet" (Buehler et al., 2015). The innovative idea of instant value transfer motivates it to be seen as the fifth disruptive computing paradigm, after the mainframe in 1970s, PC's in the 1980s, the Internet in the 1990s and Social media in the 2000s (Buehler et al., 2015; Swan, 2015).

6.2 How does it work?

To further explain how the Blockchain technology works, a description of how it is used in a transaction of a cryptocurrency, such as bitcoin, will be presented. In order to identify the sender and receiver and initiate a transaction, the system is using asymmetric cryptography, which is a system of encryption where cryptographic keys are paired. It uses two different keys; one public that is

available for anyone and one private that is only available to the owner. An encryption by a public key can only be decrypted by the matching private key (Microsoft, 2007), that is if person A should send an encrypted message to person B, she uses B's public key to encrypt the message, which can only be decrypted with B's private key.

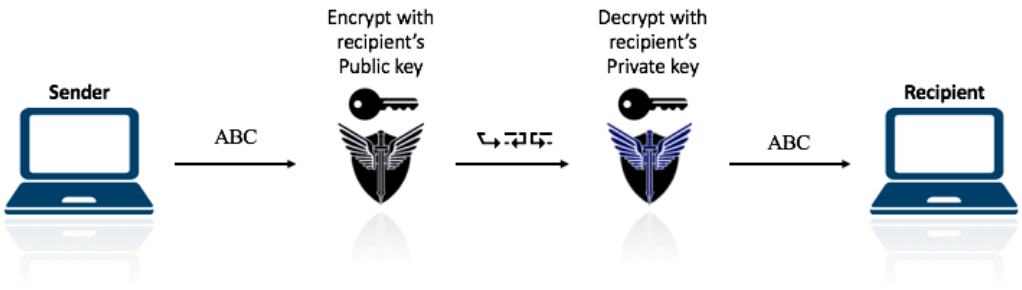

Figure 15. Asymmetric cryptography

Every wallet, containing bitcoins, therefore has two keys, one private and one public. A transaction from person A to person B starts with B sending her public key to A. A's wallet writes a payment instruction on an amount of BTC (Bitcoins) and signs it with A's private key. The payment instruction is then sent to the network of Bitcoin users, which are supposed to confirm or verify the transaction to be valid (Segendorf, 2014). Every ten minutes, the users in the network collect all transactions that have been sent to the network during the last ten-minute period. This collection of transactions is called a block and the participants that verifies the transactions of Bitcoin is called miners. The miners verify the block by adding it to the so called Blockchain, which is the official list or register of verified transactions. Since the Blockchain is public and reveals all information about the sender's as well as receiver's wallets, it can verify how many bitcoins that belongs to each wallet. A bitcoin transaction is therefore not anonymous and it is easy to identify which wallets that are involved in a specific transaction. However, it is very difficult to connect a wallet to a specific user, which means that the transaction in fact is anonymous (Segendorf, 2014).

The verification of a transaction implies that miners solves a mathematical problem, which is very hard to calculate but easy to verify. The mathematical problem is based on a hash function, which according to Wikipedia (2016) is "any function that can be used to map data of arbitrary size to data of fixed size". Furthermore, a hash function speeds up the process of lookup in a database by finding duplicates. More specifically a cryptographic hash function is used, which is a hash function that is impossible to invert, meaning that it is impossible to create the input data from the solution, also called the hash value (Wikipedia, 2016).

The miners are competing to find a solution as fast as possible, and when a solution is found it is distributed to the network where other miners easily can verify if the solution is correct. A decision whether to accept a solution or not is taken by a majority vote where the influence of a miner depends the computing capacity she contributes to the network. Once a solution has support from the majority of the network's computing capacity it is accepted. The block of transactions is then

added to the Blockchain and B gets ownership of the amount that has been sent while A is charged with the same amount. It is then impossible to alter the transactions and the transaction history will be accessible for anyone.

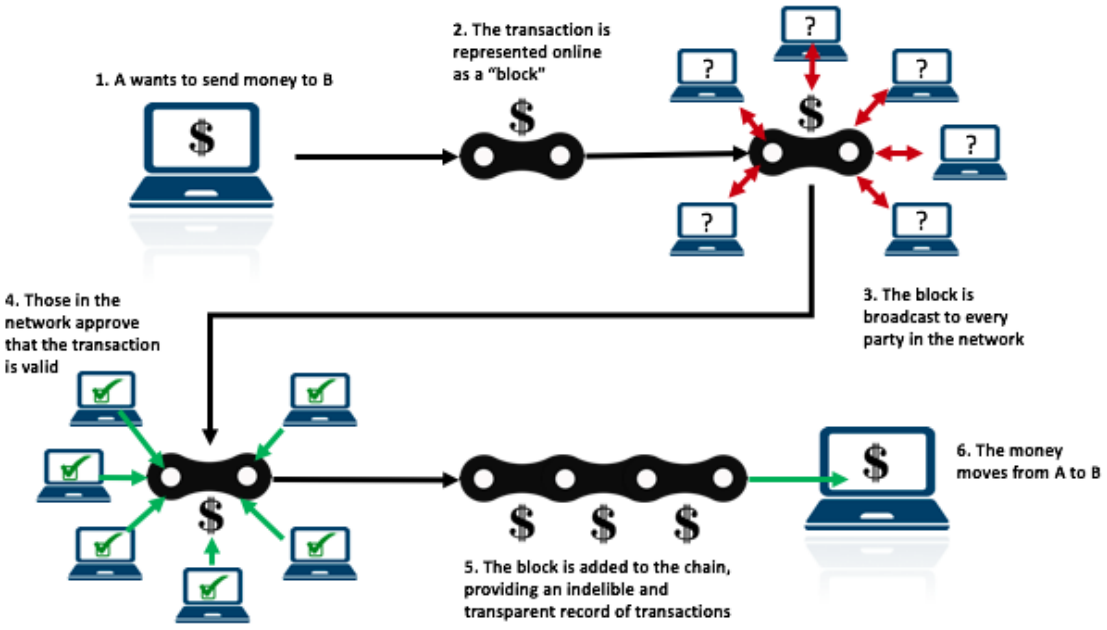

Figure 16. A transaction using the Blockchain

When a hash function is solved and a block is added to the chain, the miner who solves the function also adds another block to the chain as a reward. In this transaction the miner receives *N* Bitcoins, but no one is charged for it, meaning that *N* new Bitcoins has been created. The reason for this compensation is to provide incentives to invest in computing power for the verification process and to distribute money into the system since there are no central authority that issues new money (Nakamoto, 2008). The difficulty of the hash function and the amount on the reward *N* are changed every other week to ensure that the network verifies transactions every ten minutes.

6.3 Two types of Blockchains: permissioned ledger vs. permissionless ledger

The Blockchain that was invented for Bitcoin did not ask for permission from a central authority. This network was open to everyone and it is called a permissionless ledger (also called public ledger). A new type of ledger, a permissioned ledger (also called private ledger), has been developed, which unlike the permissionless ledger follows certain regulations and laws, and where the validators are trusted and could be held accountable for the validation of the transactions (Frøystad & Holm, 2015).

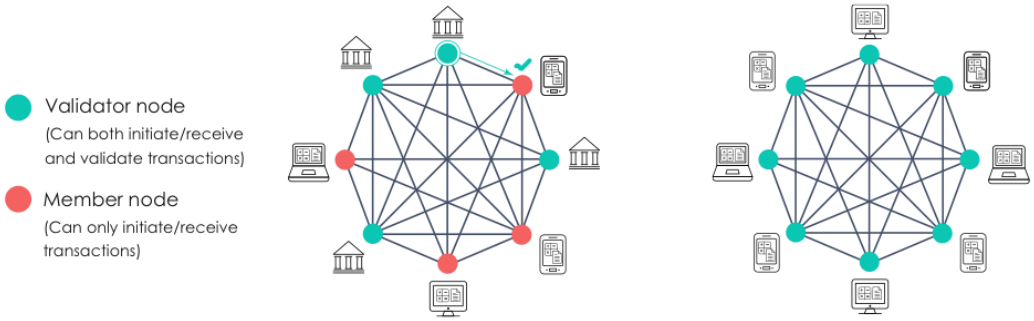

Figure 17. Illustration of a permissioned- and a permissionless Blockchain (Frøystad & Holm, 2015)

In a permissioned ledger the validation process is carried out by selected participants, for example auditors approved by the government. This kind of system could be run by a group of financial institutions and, like in the bitcoin verification, a majority of these institutions have to sign a validation. According to Frøystad & Holm (2015) a permissioned ledger is an example of a business-level system that is most likely to be adopted by companies backed by a financial institution. In the permissioned ledger all the participants in the network has to be identified, even though they only execute transaction and are not able to validate, meaning that it is not possible to be anonymous. This is similar to the identification process when a bank account is opened. The main advantages with this kind of ledger is a quicker validation process and lower transaction cost (Frøystad & Holm, 2015).

A permissionless Blockchain operates outside the legal system and aims to create transactions that are anonymous. The validation process is operated on a decentralized level by anonymous participants in the network. This kind of ledger is more appropriate for permissionless innovations and applications that need open access (Frøystad & Holm, 2015). According to Seibold et al. (2015) it is most likely that a permissioned ledger initially will be used within financial services, since there are not any well-defined legislations and regulations for the Blockchain today. By using a permissioned ledger, they can control the Blockchain themselves.

6.4 Application areas for the Blockchain technology within the Swedish financial system

First came the internet of information, then the internet of things. The next big thing in the evolution of internet is the internet of value, which implies that value could be transferred as easily as information says Chris Larsen, co-founder and CEO of Ripple Labs, in an interview with OpenMarket (2015). In this new era, the Blockchain technology will have a major impact (OpenMarket, 2015). The main feature of the Blockchain is the distributed ledger, the fact that the participant is involved, which implies that a third party will not be needed. Thanks to this, the technology provides faster clearing and settlement (Allchin et al., 2016) and reduces price of exchange, but it also improves availability and reliability (Grewal-Carr & Marshall, 2016). Furthermore, it has lower collateral requirements and counterparty risk and since it is transparent and the history is impossible to alter it facilitates audit and regulatory reporting (Brodersen et al., 2016a).

These advantages create opportunities for applications in the financial system, where central, trusted third parties traditionally has been used (Mainelli & von Gunten, 2014), ranging from payments and transaction of securities to smart contracts and smart property.

6.4.1 Payments

An inter-bank payment today needs to be processed by several institutions such as banks, clearing houses and the central bank, which is described in chapter 4. This process is not executed in real time, which means that a payment can often take one or more days, particularly during weekends (Frøystad & Holm, 2015; Bogart & Rice, 2015). To be able to execute these payments, banks have built up an infrastructure, which on average cost 7.3 percent of the yearly revenue (Frøystad & Holm, 2015). International payments are even more complicated since these involve more institutions than an inter-bank domestic payment. A remittance from a bank in the US to a European bank entails involvement of central counterparties and correspondent banks before the payment ends up in the receiving bank, which is illustrated in figure 18.

Figure 18. International payment in the current system (Frøystad & Holm, 2015)

Figure 19 is an illustration of a solution presented by Ripple, which is a company that provides solutions for financial settlement to facilitate global exchange of value (Ripple.com, 2016). They have developed a platform and partner with payment service providers, who act as gateways and hold a collateral in terms of fiat money. These gateways create digital money, as a copy of the fiat money, which can be traded with in real time in the ledger network (Frøystad & Holm, 2015).

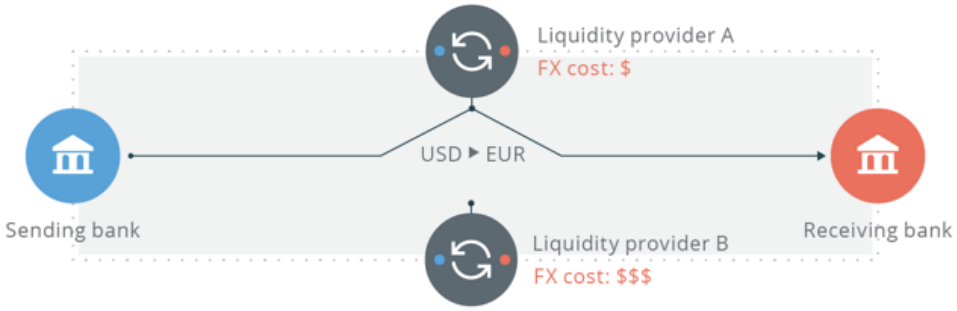

Figure 19. International payment in Ripples solution (Frøystad & Holm, 2015)

According to Frøystad & Holm (2015) the Blockchain technology will facilitate payments for a number of parties, such as consumers, small businesses, corporations and financial institutions. It will help consumers to make faster payments, due to faster clearing and settlement, and safer payments. With a payment solution based on a Blockchain, the payer does not need to disclose their financial information, as one must with a credit card payment. Credit card information that is stored at the merchant attracts hackers and thieves. Hence, a Blockchain based solution will be harder to hack and is therefore safer (Bogart & Rice, 2015).

Merchants and small businesses will be able to both receive and make payments faster (Frøystad & Holm, 2015). Furthermore, as can be seen in figure 20, there are much lower processing fees which means that merchants can save up to 80-90 percent by using a cryptocurrency payment based on a Blockchain solution, such as Bitcoin, instead of credit card payments (Bogart & Rice, 2015). To accept a payment with a credit card, the merchant is charged on average 3 percent but can accept a Bitcoin transaction for 0,5 percent (Bogart & Rice, 2015). The payments in a Blockchain are as cheap and fast for international as for domestic payments, which give merchants an opportunity to expand its business to customers worldwide. Furthermore, they will be able to eliminate the risk and cost of storing the customer's' payment information and avoid chargeback fraud (Bogart & Rice, 2015).

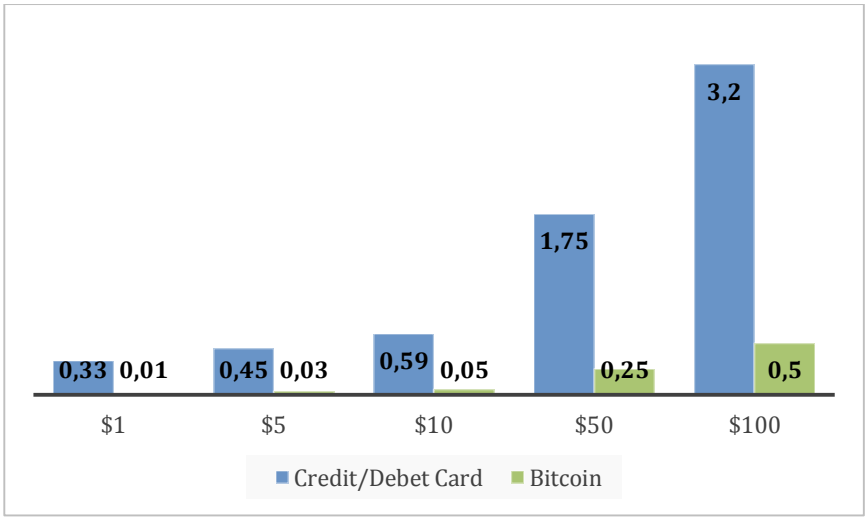

Figure 20. Comparison of transaction fees using Stripe and Bitcoin (Bogart & Rice, 2015)

In corporations it will facilitate cash management, generate working capital, speed up its cash conversion cycle and decrease the need for financing in the short term. Since international payments in the current system takes a couple of days, corporation misses return on the money for these days, which could be avoided with a Blockchain based payment solution. Financial institutions will be able to reduce the total cost of ownership and provide better online banking services, by delivering payments that are as fast for domestic payments as for international payments (Frøystad & Holm, 2015).

According to Bogart & Rice (2015), a Blockchain solution for payment services can create new payment functions, like micropayments. In the current system there is a fixed fee associated with every transaction which have made it costly to transfer small amounts. Though, with a payment solution based on Blockchain this problem does not occur and it is therefore possible to transfer micro amounts. Ludvig Öberg, co-founder of Safello, explains that this creates a new type of subscription, and Netflix could for example be paid for every minute rather than monthly (Öberg, 2016). Bogart & Rice (2015) explains a similar function where a magazine could be paid for on a per-page-read basis or per-article basis rather than on a monthly subscription. They further argue that this will favor users since they receive more value per cost paid. Furthermore, according to Lees & King (2015), the Blockchain technology has the potential to improve the efficiency of transactions and disrupt the payment industry in the near future. Transactions could also involve contracts of ownership.

6.4.2 Issuance and transaction of securities

To take a company public requires a lot of capital and many banks have to cooperate to attract investors and sign the deal. The stock exchange conveys the shares to the secondary market and ensures that clearing and settling works. The issuance of securities in the United States is nowadays a physical process, where private companies create physical stock certificates. According to Fredrik Voss, vice president of Nasdaq Blockchain innovation, the current process increases the risk of forgery and loss of stock certificates (Gustavsson, 2016). Furthermore, the existing process for trading the stocks is very slow and inefficient because of the third parties that has to be involved. However, it will be possible for companies that wish to go public to issue their shares directly via a Blockchain, and the shares can then be traded in a secondary market on top of the Blockchain (Crosby et al., 2015). The Blockchain technology would reduce number of parties involved in a security transaction, improve the processes by e.g. having automated verification of means, and they would therefore make the process faster and cheaper (Allchin et al., 2016).

Nasdaq has partnered with Chain, a startup based in San Francisco that is a leading provider of Blockchain infrastructure for issuance and management of digital assets (Nasdaq, 2015). Through the partnership, Nasdaq has developed a permissioned Blockchain that is called Linq, which is supposed to replace the current system for stocks in private companies in the United States. The securities will then be issued in blocks in Linq instead of in a physical form of paper stock certificates like it is today. Nasdaq has now started to implement the Blockchain technology in a small scale and succeeded to issue securities through Linq (Gustavsson, 2016). Voss argues that they have reduced the need for a lot of third parties. No legal intermediaries such as a clearing houses (Feedzai.com, 2016) and Central Security Depository (CSD) is needed since everything is managed through the blockchain protocol. He further explains that in Sweden, there are a book entry-system that keeps a register of who owns what company, which is managed by a third party institution, that will not be needed if a Blockchain is implemented. The only intermediary that is needed is the Blockchain (Gustavsson, 2016). However it is difficult to see the results of the Blockchain yet, but Nasdaq has

begun to explore how it can be implemented worldwide (Tepper, 2016) and Voss argues that if it proves to be effective it will be implemented on large scale worldwide.

Besides the reduction of third parties, the blockchain technology has potential to make the process of security trading a lot more efficient, to reduce the clearing and settlement time from 2 or 3 days to as little as 10 minutes (Nasdaq, 2015), which reduce both operational risks and costs (Crosby et al., 2015). Furthermore, Nasdaq (2015) argue that settlement risk exposure can be reduced by up to 99 percent. Moreover, Voss explains that a stock exchange based on a Blockchain can create other functionalities such as digital voting in the annual general meeting for shareholders. This implies that the shareholder no longer needs to be present at the meeting in order to vote. Nasdaq has started to develop a solution for this in Estonia along with a solution to improve company registration and public pension registration (Tepper, 2016).

Palychata (2016) presents two scenarios for utilizing this technology in the security exchange. The first one implies a "complete disruption" of the market, and a solution based on a distributed blockchain will give all participants access to the Decentralized Securities Depository (DSD), exchange of securities, clearing and settlement. This means that the existing players that perform these functions nowadays, might be redundant. He further argues that it is still likely that custodians launch the network or are responsible for the application on the blockchain and that an authority might be trusted to keep the private keys safe. The second scenario implies that the technology might only be used as an IT infrastructure. He states that "in this scenario custodians or settlement infrastructures might use the blockchain to record the ownership and trades between themselves; however end investors will still need to use a custodian to have access to the market". Only authorized participants will have access to the ledger. Hence, the existing actors will still have control, but their services might change.

6.4.3 Smart contracts

The term smart contract was coined in 1994 by Nick Szabo, a computer scientist, and he defined it as "a computerized transaction protocol that executes the terms of a contract" (Szabo, 1994). It is a contract that is self-administered and self-executed when certain predetermined criteria are met (Mainelli & von Gunten, 2014; Frøystad & Holm, 2015; Bogart & Rice, 2015). According to Camacho (2015), the execution in the program is completely transparent and autonomous and it cannot be reversed. He further explains that a smart contract can store money and send and receive it autonomously.

The creation of the Blockchain gave a breakthrough for smart contracts (DeRose, 2016). A Blockchain is the perfect place to store a smart contract due to its cryptographic security and immutability (Marino, 2015). A smart contract in a Blockchain is able to securely hold and release funds since it is assured from tampering through decentralized storage and execution (SmartContract, 2016). These can be developed as a distributed application on top of a Blockchain and increase speed and efficiency (Mainelli & von Gunten, 2014). Smart contracts in a Blockchain

allow parties, that are mutually distrustful, to safely engage in a contract and execute transaction without the need for a third-party intermediary. In a Blockchain solution for smart contracts, only the two persons that have entered the contract have access to the funds (DeRose, 2016) and the decentralized Blockchain ensures that the honest party get remuneration in case the other party violates the agreement or breaches the contract (Kosba et al., 2015).

A main benefit of smart contracts based on a Blockchain solution is the reduction of human involvement in creation and execution of contracts as well as in a potential litigation. A reduction in billable hours, from for example accountants and attorneys, lowers the costs for the parties involved in the contractual agreement (Bogart & Rice, 2015). Furthermore, since the smart contract has ownership of the property and is automatically executed, it can solve the counterparty trust problems (Frøystad & Holm, 2015). It reduces the mutual agreements between corporations, individuals or machines to software code that is automatically executed and enforced, which in addition to reducing costs, also reduce risk (Bogart & Rice, 2015). Smart contracts are deterministic, meaning that every possible result must be expressed in the contract in advance, which results in that ambiguity could be avoided (Mainelli & von Gunten, 2014).

According to Mark Smith, cofounder and chief executive of Symbiont, the market for syndicated loans is one of the first potential markets for smart contracts (Lee, 2015). This market has a turnover of $4 trillion and is still dependent on old fashion methods such as emails, faxes and excel spreadsheets. Smith states that they "have turned paper syndicated loans into smart contracts where the terms and conditions of the loans, including payment features, are programmed and embedded algorithmically in a digital format issued from the borrower to a syndicate of lenders across a shared ledger". He further explains that the syndicated bank loan teams at the banks they have talked to processed over 2 million faxes, up to 30 pages each in 2014. The banks employed 50 persons to just handle and deliver these contracts. The smart contracts can automate this process and restrict the transfers according to the terms in the contract, for example the loans cannot be traded on a secondary market without approval from the borrower. Today the process for a syndicated loan takes 27 days, but with a solution based on smart contracts in a Blockchain it could be reduced to two or three days. The first syndicated loan represented in a smart contract in a blockchain will launch in 2016, and Smith argues that in the same year the market for syndicated loans will change significantly (Lee, 2015). Tuesta (2015) describes that any loan can be represented as a smart contract in a Blockchain along with information of the collateral ownership. The key advantage is that the smart contract can automatically take back the key to the ownership of the collateral if the borrower does not pay in time.

According to DeRose (2016), the smart contracts will first find its niche in the underserved market of amateurs, in the same way Bitcoin started out, with potential to revolutionize financial services. Though, there are some challenges to overcome before this breakthrough can occur. One of these challenges is how an event in the physical world should initiate a digital action in the smart contract (Bogart & Rice, 2015). Furthermore, smart contracts are effective in the digital world but will at the moment not be enforceable in any court (Tuesta, 2015). Tuesta (2015) criticize the flexibility of smart

contracts since the agreement cannot be altered even though both parties may agree to change it. If these challenges could be solved, smart contracts have a potential to be the most disruptive innovation since computerized data processing, for the market of financial services (DeRose, 2016).

6.4.4 Smart property – registration and transaction of assets

Smart contract can be used in a larger extent than for just digital assets, it can be embedded in physical objects and make these objects transferable. Thereby a physical property becomes a smart property (Szabo, 1996). The idea of smart property is that the ownership of assets or property can be controlled via smart contracts by representing it as a digital asset in a Blockchain (Crosby et al., 2015). The property can be tangible such as a car, home, computer or bicycle, or intangible like shares of a company, IP, copyrights or reservations (Swan, 2015; Crosby et al., 2015). By connecting an object to the Blockchain with a unique identifier, the object can be controlled, exchanged (Swan, 2015), and the entire history of transactions can be tracked through the Blockchain (Grewal-Carr & Marshall, 2016).

Swan (2015) argues that the Blockchain technology has great potential for registering and protecting intellectual property and that it could either supplement or replace current IP management systems. Moreover, the Blockchain could be used as both a spreadsheet for registering assets and as an accounting system for transferring assets and since national borders do not matter for the blockchain, assets can be transferred worldwide. Smart property based on Blockchain solutions will work as a decentralized assets management system and will facilitate lending and reduce or completely prevent property fraud.

It is important in many financial processes to validate that documents exist and that they belong to the right person (Frøystad & Holm, 2015). The incumbent system depends on central authorities to validate and store the document, which according to Frøystad & Holm (2015) involves risks of breach, deterioration and transfer. In a Blockchain based solution, an asset can be registered and stored in the Blockchain by creating a transaction with a reference to the asset (Frøystad & Holm, 2015). These kind of transactions are carried out in a similar way as digital payments described in the previous part, but there is a slight difference. In a property transaction, the "digital coins" are not all the same. An asset, such as a house, can be associated with a particular coin or a part of a coin, which then could be exchanged as a usual transaction in the Blockchain (Grewal-Carr & Marshall, 2016). The owner of the private key, that was used to register the asset, then holds the ownership of the asset. Since every transaction of an asset is verified and stored in the Blockchain, one can keep track of the entire history of ownership and thereby solve disputes over property ownership (Grewal-Carr & Marshall, 2016).

Szabo (1996) presents an example of how to control a smart property, such as a car, by using a smart contract. He explains that, based on the terms of the contract, only the rightful owner will have control of the keys for the car. He continuous and states that "if a loan was taken out to buy that car, and the owner failed to make payments, the smart contract would automatically invoke a lien, which

returns control of the car keys to the bank". A lien is a notice attached to the property, which gives the creditor legal right to seize it if the debtor fails to meet the obligations of the contract (Investopedia, 2016). Since the "smart lien" is invoked automatically and directly if the contract is breached, it might be much more effective and cheaper than a repo man (Szabo, 1996).

6.5 Challenges and Risks

Although the Blockchain technology seems to have various application areas there are some barriers for widespread adoption and further development. There are challenges regarding technological aspects, regulatory and legal, common standards and governance, implementation, as well as institutional.

6.5.1 Technical challenges

One of the major challenges for the Blockchain technology concern scaling up if the demand for Blockchain based solutions increases. At the moment there are limitations to the number of transactions the Blockchains on the market are able to execute. For example, the bitcoin Blockchain has a limit of 7 transactions per second. This could be compared to the 2 000 transactions per second the VISA credit card network processes, and they are able to handle peak volumes of 10 000 transactions per second. The limit could be increased by expanding each block. However, this solution give rise to another problem regarding the size of the blockchain (Swan, 2015).

The size of the bitcoin Blockchain is almost 64 GB and it is growing exponentially, as can be seen in figure 21. In a public Blockchain, as for bitcoin, the growing Blockchain becomes a problem since every node that verifies transactions need to download a copy of the Blockchain. If the Blockchain continues to grow, fewer will be able to verify transaction and thereby a public Blockchain will become more and more controlled by a few number of nodes. Only 7 000 servers run a full node because it requires a lot of resources. Hence the size problem motivates a centralization of the Blockchain (Swan, 2015).

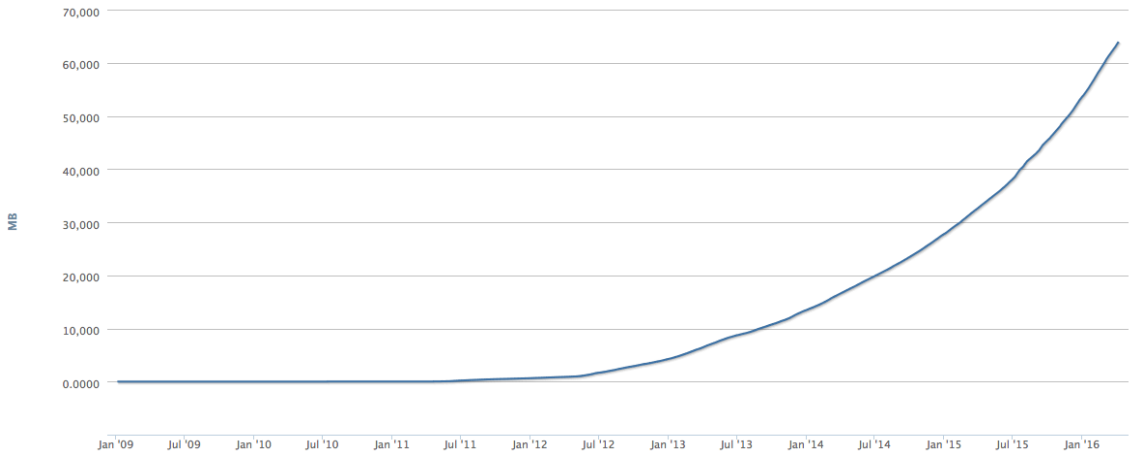

Figure 21. The size of the Bitcoin Blockchain

Centralization of the Blockchain causes additional problems regarding security. If a mining pool get control of 51 percent of the computing power in a blockchain, they get control of the entire blockchain. This is referred to as the 51-percent attack. The mining pool could thereby alter the transaction history or double-spend transactions into their own account, and thereby steal assets on the blockchain (Swan, 2015). There is a centralization trend in the Bitcoin mining, where a few large mining pools controls the majority of the computing power, which implies that the network becomes insecure (Swan, 2015).

Another threat to the security of the Blockchain is the emergence of quantum computing (Crosby et al., 2015). The blockchain technology is based on the fact that a single person cannot get control of the network because no one has that kind of computing power. However, tests have shown that quantum computers, for certain types of problems, are 35 000 times faster than conventional computers (Holmberg, 2014). This implies that the cryptographic keys may be easy to crack through sheer brute force with a quantum computer. Hence, the system will be much more vulnerable to attacks unless the keys become harder to crack.

6.5.2 Regulatory and legal challenges

According to Swan (2015), the governmental regulations play a large role in whether the blockchain technology will develop into a financial service industry. A major challenge regarding the legal aspects of the blockchain technology is that the current tax structures are insufficient to ensure that taxes are paid. Hence, Swan (2015) argues that the taxation system may shift from an income tax-based system to a consumption tax-based system, where physical assets, such as cars and houses, might be taxed harder. Besides the implications for taxations, it also affects economic performance measurements like GDP calculations.

According to Crosby et al. (2015), the government agencies might create new laws to regulate the industry, which may slow down the adoption. Tough, at the same time, the government bring trust, which might accelerate the adoption. Furthermore, the security feature, that the transaction history is impossible to alter, brings judicial implications since regulators will not accept that the system denies their lawful intervention (Allchin et al., 2016). Regulators will most likely require to be able to monitor transactions in the ledger in order to prevent money laundering and terrorist financing processes, which will affect the privacy in the system (Allchin et al., 2016).

6.5.3 Privacy and cultural challenges

The main problem with the high level of privacy in the system is if the private key is exposed or stolen. Then all assets might be lost, since the private key is the only thing that is needed to transfer the assets. This is one of the issues that keeps people from feeling comfortable in the system (Swan, 2015). The blockchain technology might totally shift the way this industry works, the trust is moved from central authorities to a decentralized network. The change with the blockchain is predicted to be about 80 percent business process change and 20 percent technology implementation (Shelkovnikov, 2016). There is generally a resistance to change that needs to be handled before an

industry-wide implementation of the blockchain technology will be possible (Crosby et al., 2015). Shelkovnikov (2016) suggests that an imaginative approach is needed to understand how things will change and what opportunities it will bring. Furthermore, Lüning & Sundström (2016) argue that the Blockchain will create many challenges regarding security and protection of the personal integrity that needs to be solved in order for it to be appropriate for the individual citizen to use.

6.5.4 Common standards and governance

The future for the Blockchain is still unclear since a dominant design is not established in the industry and it is uncertain what will be "the new normal" (Brodersen et al., 2016a). Many different solutions are developed on different standards and organizations are creating their own Blockchains. This implies that the applications that runs on top of these different solutions are not able to interact with each other. Hence, the benefits of a decentralized ledger cannot be fully achieved (Shelkovnikov, 2016). Crosby et al. (2015) argues that industries have to agree on the design, initial scoping and standards for interoperability for a Blockchain solution. They continue by stating that "there will need to be clear agreement on how Blockchains will be managed and improved once they are alive. This would involve governance processes, update approvals, roles and responsibilities, and so on."

6.5.5 Implementation challenges

A question that arises with the emergence of blockchain is how the assets is to be transferred from a traditional ledger to a blockchain solution (Brodersen et al., 2015). Also Crosby et al. (2015) have recognized the extent of migration tasks that need to be performed in the transition, e.g. it may take some time to migrate real estate ownership documents from county or escrow companies to the Blockchain. Lüning & Sundström (2016) argues that the large financial institutions have outdated system infrastructures, which will be a major challenge when new technologies are integrated. Furthermore, an implementation of a new technology carries operational risks, in terms of technical failure by running parallel infrastructures or a more radical shift of infrastructure. In order to minimize these operational risks there is a need for quick recovering or be able to quickly go back to the previous system in case of technical failure (Allchin et al., 2016).

6.6 The future of the Blockchain technology and strategies to leverage it

The adoption of the Blockchain technology will most certainly be gradual, it will not happen immediately. Crosby et al. (2015) expects a slow adoption because of the risks the technology carries, where many startups will fail and few will survive and succeed. They argue that a significant adoption will probably take place in 10 to 20 years. Buehler et al. (2015) expect the development to take place in four steps. Initially the technology will be adopted by single businesses across legal entities. Secondly, small subset of banks adopts the technology in order to upgrade manual processes. Thirdly, an adoption to standardize products in interdealer markets is likely followed by adoption in the public markets by buyers and sellers and thereby involve the end investors (Buehler et al., 2015).

According to Brodersen et al. (2015) many firms are in the exploratory phase, where they are testing the Blockchain technology internally in their own research labs. 2015 was characterized by exploration and investments where companies started assessing use cases and adopted the technology for internal reconciliation. 2015 was a year of awakening for many participants in the capital and financial market (Gustavsson, 2016). At the moment, the investment banks are developing permissioned Blockchains to run internally until regulations are established and the market is ready to appreciate the services that could be enabled with a Blockchain solution. Brodersen et al. (2015) further expect that the early adoption will take place in 2016-2017, where the leading banks will realize the value of a Blockchain solution. The early adoption will also be driven by regulatory authorities that sees the advantages for auditing and compliance, and new rules and regulations will be developed. Fredrik Voss agrees and argues that we will start to see Blockchain solutions launched on the market in 2016 and that Nasdaq and other actors can evaluate and draw some conclusions of the technology in the end of the year (Gustavsson, 2016). Brodersen et al. (2015) predict the growth of the adoption to take place in 2018-2024 where other banks will realize the benefits that are presented by the early adopters. Also, the regulations have started to change, which will contribute to network effects. In this phase, new service providers, business models, products and services are developed while some old ones may be replaced. The maturity is expected to be reached in 2025, where the Blockchain will be well known and seen as an established technology in the capital market ecosystem (Brodersen et al., 2016).

As stated above, the fully adoption of the Blockchain technology is expected to take years, but the participants in the capital markets need to set their strategies to be able to reap the value of the new technology. Buehler et al. (2015) suggests four actions in order to leverage the technology. First of all, the companies have to invest in expertise and the technology, and work for industry wide change. If the business model is a threat of disruption, the impact of such disruption must be mitigated. Frøystad & Holm (2015) agrees with this suggestion and states that companies should conduct research and workshops, and ensure that employees are educated in the area. Secondly, participants in the industry must work together, form consortia, and include regulators early in the process. Fredrik Voss also argue that the Blockchain technology will only work at its full potential in a network (Tepper, 2016). The solution needs cooperation among participants in the market, technology providers and banks needs to create a common platform and set standards for the blockchain technology (Buhler et al. 2015; Frøystad & Holm, 2015). Thirdly, companies should seize the opportunity of internal ledgers, which will give them knowledge about the technology without risking any network issues. It will make it possible for companies to test the technology in existing systems. Furthermore, testing the technology may allow firms to find additional application areas for the technology (Frøystad & Holm, 2015). Fourthly, a recommendation is to focus on post-trade activities and processes, which can give workflow benefits and the business models might be less disruptive (Buhler et al. 2015). Furthermore, Frøystad & Holm (2015) argues that banks need to rework their trading process since intermediaries and delays are removed. The steps in the process of settlement and clearing that are not needed anymore need to be removed.

7. The Internet of Things

In the following sections the IoT will be explained in terms of applicability in the Swedish financial system. The potential challenges and risks with adopting will be covered, as well as future outlook for such solutions.

7.1 What is Internet of Things?

The Internet of Things (IoT) is the network of physical interconnected objects that are able to collect and exchange data. Unleashing the technology, or more accurately approaching the vision of an interconnected society, is a step towards that data gathered from remote sensors can be combined with data received from other sources. This would allow for development of synergistic services that go beyond their current state in an isolated system. The increasing interconnectivity and control of physical objects would make it possible to generate and gather immense data flows. The analysis of the data would allow for new insights that are expected to impact individuals, businesses, and the community as a whole. According to analysts at Gartner (2013), there will be about 26 billion of connected objects worldwide in 2020, excluding PC's, smartphones, and tablets. As a result, one can expect to see value creation in the way we live, the way we work, and the way we do business.

From the technological point of view, the IoT is not that radical considering that the complementary technologies such as miniaturized and cheap sensors, networks, and smart devices already are available throughout the society. Want et al. (2015) mean that the IoT already exists, but only for products compatible with a successful business case, meaning that only a few projects are getting funded. The IoT is in fact the rise of embedded systems; basically allowing to connect and control a formerly un-computerized object that can gather data and communicate it over the internet (Kopetz, 2011). What is more revolutionary than the actual technology are the possibilities of combining the increasing number of connected objects to monitor and remotely control them, and the synergistic services that will transform how people and businesses will work through new interactions between humans and machines.

In order to realize any of these kinds of services, there are some elements that need to be in place to provide the necessary capabilities; objects must be identifiable with a unique address and able to understand their environment or a certain objects condition, and these must also be able to communicate data to be processed into information through either a gateway or directly via the Internet.

Al-Fuqaha et al. (2015) and Severi et al. (2014) state that the connected objects should be able to collect and process information in real-time. They suggest that smart sensors, actuators, and wearable sensing devices are suitable for this purpose. Optimally, sensors should consume little energy and be powered from a self-sufficient energy source since they are expected to move around and not necessarily be connected to a power source (Mattern & Floerkemeier, 2010; T. Fängström, personal communication, Mars 21, 2016). Additionally, batteries are a less attractive solution since it would be difficult and costly to access and replace those (Ballve, 2014).

Connected objects can either communicate directly to a cloud server or through a gateway such as a smartphone. Whereas objects in the first category are said to be networked, objects in the latter category can be classified as either networked or passive (Want et. al, 2015). Passive objects require a tag rather than a sensor, a gateway, and a proxy web server in order to provide the object with web presence. A passive object could, for example, be an advertisement poster with a QR code, which through a smartphone gives access to a web page where specific information is communicated. However, in order to create IoT solutions that differentiate from the usual web page based internet, one needs networked object that automatically can acquire, process, and communicate contextual information in real-time by themselves (Severi et al., 2014).

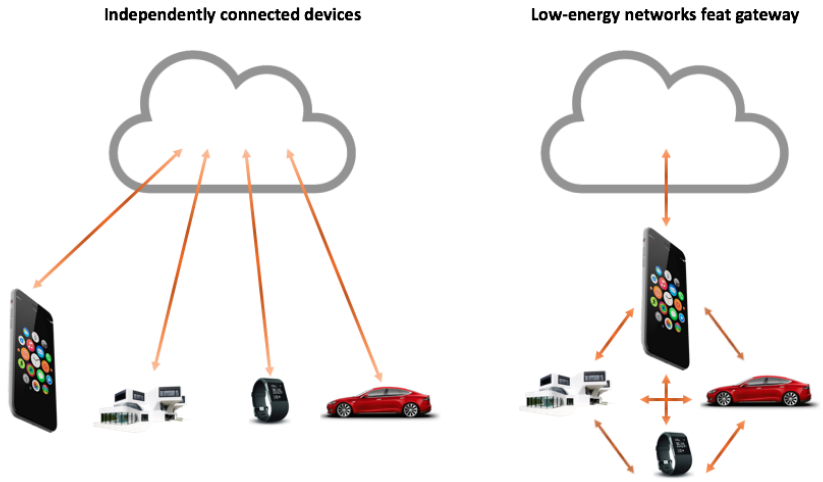

Figure 22. Independently connected devices vs. low-energy networks feat gateway

One alternative to do so is to provide each object with enough processing capacity to allow it to connect independently to the Internet for communicating sensor data, basically making the object into a small computer. Full internet coverage is however costly and burdensome since many connected objects are expected to be simple and have low-performance (Want et al., 2015). Thus, it is more compelling to use cheaper and less energy consuming sensors. Simple devices do, however, suffer from constrained network capabilities in terms of computing, cryption, and storing etc., meaning that they lack compatibility to communicate on a regular wifi using IPv6 (Want et al., 2015). Instead, these have to communicate on short range low energy networks (Severi et al., 2014). Independently connected devices can transfer information through a wifi to a server by themselves, but while using low energy networks, a gateway supporting wifi is needed to transfer the data to a server for computation.

The processing of data generated through sensors and communicated from objects is basically the "brain" of the IoT. There are several software, hardware, and cloud platforms allowing to provide IoT functionalities (Al-Fuqaha, 2015). These must be able to handle a huge amount of data input

from all connected objects and devices, aggregate it to avoid acting on a single object, combine it with data from other sources such as customer data, and all of it in real-time (Google, 2016).

7.2 Application areas for the IoT in the Swedish financial system

IoT applications are already present in several industries. Sensors in manufacturing processes allow for optimization, supply chains are made more efficient, environments are monitored to allow for lowest energy consumption possible, and even farmers are allowed take specific actions based on analyzed sensor data to optimize their growing of crops – the list goes on. Eckenrode (2015) suggests that there are possibilities for IoT-based services to be created within several areas of the financial system since it is very dependent on information. Although financial services tend to be intangible these can still benefit from tangible 'things' driving data.

7.2.1 Usage-based insurance & managing future risk

Eckenrode (2015) states that the most mature and perhaps most obvious usage of IoT-generated information is within property and casualty insurance, an area where the amount of sensors is expected to grow globally at a compound annual growth rate of 71% until 2020. The traditional insurance process starts with pricing risks based on a combination of data submitted by the customer and some third party data. This data is then processed in the insurer's loss models based on historical statistics. After binding an insurance, customers and insurers generally does not interact unless there are claims, and risk profiles are only reflected upon during renewal of the insurance (Bruno et al., 2015). By using continuously gathered sensor data rather than less accurate standard proxies, insurance companies would be allowed to offer tailored insurances for the specific individual, so called usage based insurance or UBI (Eckenrode, 2015). These do in turn allow for additional services to build upon the value proposition, such as managing of future risk.

One of the biggest benefits with usage-based insurance is increased pricing accuracy (Bruno et al., 2015; Eckenrode, 2015; Reifel et al., 2014; Dahlberg et al., 2016; Chui et al., 2010). By gathering individual empirical real-time data, it can be combined with data from multiple sources such as traditional historical data on certain segments, to set an insurance premium that is more accurate with respect to the specific customer. There is value to be gained for both customers and insurers by making these services more personal (Bruno et al., 2015; Eckenrode, 2015). Customers would be allowed to pay a premium that is more appropriate for their risk, and through continuously getting new insights on customer behaviour, insurers would be allowed to refine insurance premiums more often. More frequent renewal would increase the customer touch points and allow for a closer relationship with the customer. New offers and a better customer experience could be provided resulting in increased customer stickiness (Sandquist et al., 2015; Bruno et al., 2015; Friedman & Canaan, 2014). Moreover, customers perceive today's insurance contracts as difficult to understand and claims processes as complicated and time consuming (Shelkovnikov, 2016). UBI would thus provide additional value for customers and insurers since more timely gathering of data would allow to speed up the claim process (Reifel et al., 2014; Dahlberg et al., 2016), and allow for an increased possibility of detecting fraud (Reifel et al., 2014).

Similarly, Eckenrode (2015) means that usage-based insurance would allow for a more relevant premium, which consequently would result in a higher degree of customer satisfaction. Dahlberg et al. (2016) and Fängström (2016) do, however, question the acceptance of such pricing models, considering that it might be more expensive for some customers.

In order to realize the value from providing usage-based insurance services, insurers are required to be aware of consequences such as increased focus on data management and partnerships with other players in the IoT ecosystem (Sandquist et al., 2015; Bruno et al., 2015). Eckenrode (2015) states that IoT-generated data might overwhelm current technologies that is used for data management, which further implies the need of adapting, possibly by new partnerships. Reifel et al. (2014) states that insurers have the opportunity to expand their value proposition beyond offering insurance, and that they possibly are required to do so in order to retain customers. Furthermore, assuming insurers would succeed with redeveloping their insurance model, such services with similar premiums would ultimately imply less comparability between insurance companies, requiring these to come up with new ways of standing out from competitors (Bruno et al., 2015). Friedman & Canaan (2014) means that insurers must convince customers about the benefits of being monitored and what sets them aside from competitors. Initially this could be done by price discounts, but in the long run insurers have to provide an attractive customer experience.

An opportunity for differentiation and perhaps the most significant value creation with IoT-based insurance is to actively manage customers' risk to lower claims. This would allow insurers to move up the value chain, helping consumers to prevent a potential loss instead of just offering compensation for an accident that has already happened (Sandquist et al., 2015). Premiums linked to the customers' behaviour and the condition on their belongings would most likely incentivize them to behave and handle their possessions more safely (Eckenrode, 2015; Bruno et al., 2015; Reifel et al., 2014). There is, however, an opportunity for significant value creation for insurers by introducing risk management services since these would allow for additional customer touch points that could increase customer loyalty, allow insurers to differentiate themselves, and ultimately reduce claim losses (Bruno et al., 2015; Friedman & Canaan, 2014). The insurer would become a kind of concierge providing proactive risk management, with an overall reduced risk as a result (Bruno et al., 2015). Additional incentives for behaving safely could be provided through gamification strategies, where customers are rewarded for behaving in a certain way or contributing with additional valuable data (Reifel et al., 2014; Eckenrode, 2015; Friedman & Canaan, 2014).

It is necessary for insurers to build high customer trust to be able to act as a manager of future risks and to get customers to follow certain advice. Providing advice on how to behave also indicates that there is a need for clearly stating the liabilities. Insurers must be prepared to face situations where customers want claims although they have rejected advice, as well as situations where there are losses due to following advice (Bruno et al., 2015). Reifel et al. (2014) means that an increased focus on preventing accidents will change the fundamental economics of the industry, and that insurers must be prepared to handle rare, high severity events that are hard to predict and price.

The most significant emergence of value creation through insurance based on sensor technology is within auto insurance, where sensors in the car generate and communicate data about how the car is used. Data based on driving history, such as distance driven, accelerations, harsh brakes and so on, would reflect the performance of the driver more accurately than data based on model of the car, the age and gender of the driver etc. For example, by using data on driving history, and combining it with third party data such as weather data, insurers can actively advise customers how to drive more safely and lower their risk, thus lower claim losses. Another application area that is emerging is home insurance where sensors give an understanding about a home's condition. By allowing insurers to combine the sensor data with for example area specific data about the neighbourhood, there would be more accurately priced insurance premiums. Furthermore, by knowing the conditions of a home, accidents such as water leakage could be prevented before an emergency happens, thus reducing insurance claims. Similarly, insurers can use wearable devices to set a premium for life insurance, and by engaging more closely with the customer, insurers can suggest how to manage future risks, which thereby results in lower claims (Sandquist et al., 2015).

7.2.2 Deciding Creditworthiness and Business Valuation

In the fixed-income market, Eckenrode (2015) suggests that IoT-applications might help banks to improve underwriting processes for loans. It is expected that sensors useful for banks will grow globally by a compound annual growth rate of 34% until 2020. By using sensor gathered data, banks can get additional sources of information to decide creditworthiness. This data would be a complement to already existing data sets and it could also be valuable when there are customers without an existing credit history (Eckenrode, 2015). The challenge is to decide which kind of data that is useful for deciding creditworthiness.

Furthermore, IoT-applications generating condition data of physical assets would be valuable for financial institutions operating in the fixed income market and the equity market, assuming these are involved in valuing businesses and the purchasing or leasing of the assets. Eckenrode (2015) states that this would allow customized credit offers and allow to perform more precise valuations of assets. Knowing the condition of a customer's asset would allow a bank to proactively make credit offers to customers knowing that their asset is about to become obsolete. Furthermore, monitoring the condition of leased equipment would facilitate determination of a more precise residual value. Additionally, monitoring the condition would make it easier to determine potential discounts or penalties (Eckenrode, 2015).

Fängström (2016) further discussed the possibilities of IoT for valuation. He suggests that gathering condition data of assets might be useful as a complement to depreciation, which is relevant for accounting but not necessarily represent an accurate value of an asset. Instead of making flat rate decisions of the decreasing value of an asset, complementing IoT-gathered condition data would allow for a more accurate valuation when doing due diligence or to set a more accurate price in case of IPO or acquisition.

7.3 Challenges to become fully connected

Even though the opportunities of IoT-based solutions seem applicable for financial services, there are several barriers that inhibit widespread adoption. As previously mentioned, the technology behind the IoT is basically already available throughout the society. Instead, challenges are due to a lack of technological convergence, necessary capabilities of handling an increased amount of data, the reliability and accuracy of data, as well as security and privacy issues with gathering and sharing it.

7.3.1 Lack of technological convergence

There are several emerging standards for IoT-based solutions, and although this can be seen as a development it might be one of the biggest barriers for growth (Al-Fuqaha et al., 2015; Dahlberg et al., 2016; Reddy, 2014). The expected increasing amount of connected devices, service providers, network types, and protocols, impose a threat towards the interoperability of the IoT (Reddy, 2014). Mattern & Floerkemeier (2010) states that smart objects will be extremely diverse and will most likely provide different information, vary in processing and communication capability, as well as in energy and bandwidth requirements. They stress the importance of common standards to facilitate communication and cooperation, and especially standards for the addresses of the smart objects similarly to what IP addresses are the standard for the traditional Internet.

Al-Fuqaha et al. (2015) means that scalability of the IoT is dependent on the ability for customers to add additional services and functions without negatively affecting the quality of existing ones, and that the end consumers must be able to benefit from services regardless of the specifications of the hardware platform they use. This is supported by Dahlberg et al. (2016) who states that having to use different interfaces for different functions might inhibit adoption of IoT-based services. Similarly, Reddy (2014) states that organizations need smart devices that are able to interact with multiple services, and that different emerging standards will most likely make it difficult to integrate applications and devices. Al-Fuqaha et al. (2015) suggests that IoT applications must be designed from the ground, meaning already in the design phase of connectable devices. Thus, the convergence problem involves several parties; from application developers, device manufacturers, and IoT-service providers to end-consumers of those services.

7.3.2 Limited data management

As previously mentioned, an increasing amount of connected devices would generate immense data flows, which is necessary for IoT-based services since these require a certain amount of data in order to give valuable insights. Mattern & Floerkemeier (2010) states that some applications might only involve infrequent smaller scale communication, but that sensor networks for real-world awareness would imply huge volumes of data that needs to be handled. Handling an increased amount of data would imply challenges on traditional infrastructure in terms of capturing, routing and analyzing data (Reddy, 2014). Eckenrode (2015) agrees, stating that banks and insurance companies already struggle with large amounts of data, and the predicted amount of IoT-generated data might overwhelm their current systems for analyzing. He stresses the importance of putting effort in capturing specific data to minimize the risk of overload.

7.3.3 The need for reliability & accuracy

Access to a huge amount of data does not necessarily imply a valuable and successful IoT-service. Not all IoT-generated data will be useful, which requires organizations to carefully think through which data that should be captured - data used for analyze needs to be both reliable and accurate (Eckenrode, 2015). Al-Fuqaha et al. (2015) mean that availability of reliable data is a criteria for success of the IoT-based service, and that a system is reliable when it is working well with respect to its specifications. Mattern & Floerkemeier (2010) states that one should be prepared for unexpected and rapid change of conditions due to that the real world is much more dynamic than the digital, and discusses which level of fault tolerance that should be accepted for the IoT. They conclude that infrastructure has to be robust and trustworthy, and that there has to be abilities for automatically adapt to changed conditions. Al-Fuqaha et al. (2015) stress that IoT devices need to be monitored and evaluated in terms of processing- and communication speed, and concludes that reliability in all the layers of an IoT-system is crucial for dependable services, hence adoption of IoT-technology.

Unreliable gathering, communication, or processing of data could lead to delays, loss of data, or misinterpretation, which would ultimately result in bad decision-making with potentially severe consequences (Al-Fuqaha et al., 2015). For example, an insurer has to decide which data that is needed for accurately deciding a personalized price premium or provide relevant risk advice, and the reliability has to be high in order for those services to make sense.

7.3.4 The importance of security & privacy

When physical objects are connected to the internet, made into smart objects, these enjoy benefits of becoming for example programmable, addressable, and communicable, but it also means that these become hackable (Stegmaier & Hall, 2014). The traditional internet already has established security measures that might be used for IoT-structures too, but the applicability for all IoT applications is still unclear (Want et al., 2015). Security issues are a big challenge for the emergence of IoT (Al-Fuqaha et al., 2015; Eckenrode, 2015; Reddy, 2014). Al-Fuqaha et al. (2015) states that with the lack of technological convergence, IoT networks are expected to be somewhat heterogeneous, which imposes difficulties for guaranteeing privacy and security. Fängström (2016) also see a big challenge with security considering that smart objects would require a certain level of computational performance in order to be able to encrypt data and make sure it is sent to the correct receiver. He emphasizes the importance of having standardized systems for achieving security synergies. Additionally, many devices are expected to work automatically without human interference, which further implies that organizations has to be aware of hacking issues (Reddy, 2014).

In addition to device security, Stegmaier & Hall (2014) emphasize the importance of protecting databases storing the increasing volumes of IoT-data since consequences of a database breach would be critical for several parties. Similarly, Reddy (2014) states that a security breach would be catastrophic for the IoT-ecosystem, and Eckenrode (2015) states, that "protecting data privacy and security should be of paramount importance, especially for financial institutions". With an increasing number of devices capable of collecting data, it is not obvious for individuals

which kind of data that actually is collected and that raises serious privacy concerns (Reddy, 2014). Dahlberg et al. (2016) means that privacy is in the center of the IoT emergence, and that transparency about which data that is gathered and how it is used is important for adoption among end consumers – the ones sharing their data. Stegmaier & Hall (2014) explains that "notice and content" generally is required when it comes to services based on personal data. It means that individuals has to be informed about the purpose of the collection and processing of their personal data, and that they have given consent to sharing it. However, considering the expected daily interference with hundreds of new connected devices, the concept of "notice and consent" might become unworkable (Cate & Mayer-Schönberger, 2013).

7.4 The future of internet of things within the Swedish Financial System

Internet of Things is currently at the top of Gartner's so called hype cycle, meaning that it is at its peak of expectations. From this point, it has to pass the trough of disillusionment and the slope of enlightenment in order to finally reach the plateau of productivity, which is expected to happen five to ten years from now (Nutall, 2015). Espinel et al. (2015) states that the tipping point of the IoT would be one trillion sensors connected to the internet globally and expect this to happen in 2022.

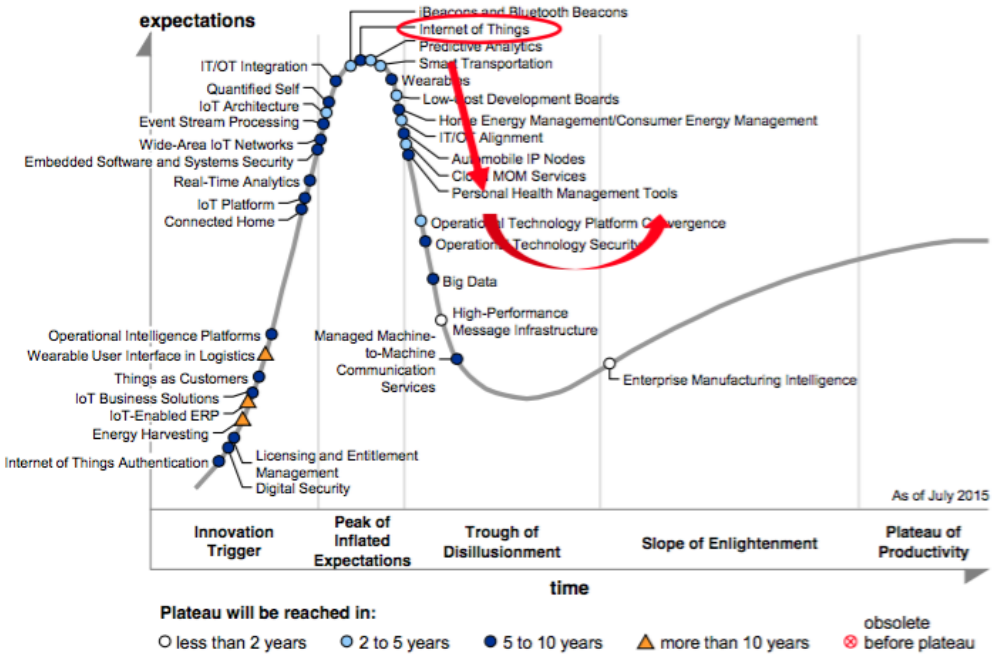

Figure 23. Gartner hype cycle (Nuttall, 2015)

The Nordic countries are in the front of the IoT development with a high number of connected devices per capita and widespread ICT-infrastructure (Dutta et al., 2015). Dahlberg et al. (2016) present that the Nordic IoT-market in 2015 was estimated to 5336 million euro where the Swedish IoT-market accounted for 35%, and state that the preconditions are excellent for further development of the IoT resulting in an expected growth rate of 17% per year until 2020.

Usage-based insurance is already gradually moving away from the sketching board into reality. According to Sandquist et al. (2015), 50% of European auto insurers have launched or are piloting sensor-based initiatives, and Reifel et al. (2014) expects that such services will grab a 30% market share in the U.S by 2025. Furthermore, 39% of insurers around the world have piloted or launched initiatives using health and fitness monitors (Sandquist et al., 2015). More specifically for the Nordics, IoT within insurance is expected to grow 27% per year 2015-2020 corresponding to revenues of 309 million euro excluding the actual insurance premiums in 2020 (Dahlberg et al., 2016). The hype is real indeed, considering that less than 15% of financial services institutions, and less than 10% of insurance carriers were implementing or planning to implement IoT solutions in 2012, according to Forrester Research (Eckenrode, 2015).

From the end-consumer perspective, Friedman & Canaan (2014) expect the global number of users within IoT-based auto-insurance to reach 89 million in 2017. They have identified that age is a differentiator when it comes to adopting such services, where willingness to adopt is significantly higher among younger people. This is in line with what Bothun et al. (2012) present, that willingness to share personal data decreases with age.

Eckenrode (2015) suggests that firms within financial services that has not already started IoT initiatives should begin planning for the IoT as a new source of data. Friedman & Canaan (2014) state that insurers adopting IoT early on have the opportunity to a competitive edge against competition in terms of first-hand experience and collection of data for future underwriting and pricing. These are mostly bigger companies pushing initiatives to customers by offering discounted coverage. Later adopters may learn from the mistakes made by early ones, but they will most likely face a great burden trying to catch up with gathering data and deriving value from it. Insurers deciding to not adopt the IoT and instead keep using their traditional business model, might miss out on the opportunity of additional customer touch-points and face challenges such as an overall inferior customer experience, resulting in a lack of customer loyalty (Friedman & Canaan, 2014).

Eckenrode (2015) means that the understanding of where the IoT is heading can be increased by developing partnerships across a wide spectrum, and that recommends experimentation with existing partners with a test-and-learn approach in mind. He sees potential for both banks and insurance companies within this area. Reifel et al. (2014) agree with the test-and-learn approach, and emphasizes engaging in flexible partnerships even though not all partnerships within the firm's ecosystem will be useful. It is more relevant to look at the IoT-ecosystem, which most likely differs from the firm's traditional one. For example, telecom and ICT companies have already established partnerships with insurers in order to further explore IoT services, and acquisition of start-ups not related to the core business could also prove to be valuable for advancement (Dahlberg et al., 2016).

Reifel et al. (2014) mean that a deep understanding of the customers and their needs is crucial to develop relevant IoT applications, and that sharing learnings and benefits with existing customers is useful for optimizing the customer experience, thus the service. Nutall (2015) suggests that firms should help their consumers to identify real-world use cases to increase their willingness to adopt.

Furthermore, since IoT services for financial institutions and insurers would involve personal data, it is likely that there will be security and privacy concerns. Stegmaier & Hall (2014) states that one should "assume someone will try to hack your device or service". They mean that these challenges should be recognized from the start of IoT initiatives, but also that building consumer trust by guaranteeing security and privacy could be used as differentiating features for increased adoption.

Europe is highly engaged in creating the prerequisites for development of the IoT and has been relatively successful so far (Expert Group on the Internet of Things, 2016; Dutta et al., 2015). There is however a tradeoff between introducing laws and regulations and letting the market develop by itself. A negative effect of introducing laws and regulations could be development of a non-optimal solution. Vice versa, a negative effect of not introducing laws and regulations could be that organizations develop their own in-house solutions (Expert Group on the Internet of Things, 2016).

8. Analysis

This chapter contains the analysis of the emerging innovations within the financial system. Initially, P2P marketplaces will be analyzed where P2P lending and Debt crowdfunding have been separated from P2P currency exchange and Equity crowdfunding since some relevant factors for these differ in multiple steps of the model. This is followed by an analysis of the Blockchain technology where payments and transaction of securities will be treated separately and lastly Usage-based insurance will be analyzed.

For deciding whether incumbent firms as well as systems and infrastructures in the Swedish financial system face a potential disruption from emerging innovations we have used a modification of the tool for identifying a firm's enemies presented by Rafii & Kampas (2002), influenced by the attributes of adoption, the business model canvas, institutions, and entry barriers. Starting out with the suggested steps and as many of the suggested factors as possible from the original model, we have added relevant factors, based on other theories from the theoretical framework, and removed irrelevant ones within each step. Further, we have rated and weighted each factor individually, based on the empirical findings, in order to be able to decide it's disruptiveness through discussion.

8.1 Peer-to-peer lending and Debt crowdfunding

In order to analyze the disruptiveness of P2P lending and Debt crowdfunding, we have placed the P2P platform providers as the insurgents and established banks as the incumbents.

1. Foothold market entry - can the insurgent gain a foothold (usually in the market below the main one)?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Targets people who historically lacked skill or money to buy	+3	3	+9
Underserved segments	+3	3	+9
Previously unprofitable low-end markets	+2	2	+4
Insurgents presence in the foothold market	+2	2	+4
Averages		Average weight = 2.5	Average score = 6.5
Normalized score = + 2.6			

With a normalized stage score of +2.6, insurgents within P2P lending and Debt crowdfunding are expected to gain a foothold, which means enabling of disruption. These platforms target a customer segment that historically have not been able to borrow money due to that they are unattractive to banks (+3). The foothold market consists of borrowers that either have too low creditworthiness or lack credit history, meaning that an underserved segment is targeted and thus enabling for disruption (+3). Since the borrowers in this customer segment have not been able to get a loan, one can assume that it has not been profitable enough for banks. Hence, the market can be considered an unprofitable market, which enables for disruption (+2). Furthermore, insurgents are present in the

foothold market since there are several actors providing P2P lending and crowdfunding platforms, which is slightly enabling of disruption (+2).

2. Main market entry - does the insurgent face high barriers to enter the main market?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Network effects	-2	2	-4
Capital requirements	+3	2	+6
Formal institutions - laws, regulations, rules	-1	3	-3
Averages		Average weight = 2,33	Average score = -0,33
Normalized score = -0.14			

With a normalized stage score of -0.14, it is difficult to tell whether there will be disruption or not according to Rafii & Kampas' (2002) framework. There is a barrier for entering the main market in terms of network effects needed (-2), meaning there is a need to scale up the business in order to be able to compete. A P2P platform needs attractive investment opportunities to attract investors and at the same time, they need investors to attract borrowers. According to the capital buffer act, banks are required to possess capital buffers beyond their capital needed for operations. Hence, this is one of a bank's key resources and a major barrier for starting a bank. However, it is irrelevant for P2P lending and Debt crowdfunding since these do not bear any of the capital used for loans on their balance sheets. Hence, there are low capital requirements and thus enabling for disruption (+3).

There are certain formal institutions for a credit institutions, meaning that there are government policies, laws, regulations and rules that they have to follow, which may be a barrier for entering the market. This factor is very important since a law might make it impossible to enter and operate on the market. There are other formal institutions, besides the capital buffer act, to which a bank or "lending organization" must comply. A company receiving funds for dissemination of loans must get an approval from the Swedish financial supervisory authority in order to provide payment services and they need to get permission to work as a consumer credit institution to disseminate loans (Finansinspektionen, 2015a). This is something that P2P lending and Debt crowdfunding have to comply with in order to be allowed to offer their services. It is therefore a barrier to start a lending business. However, there are several companies, such as Lendify and Saveland, that have proven that permissions for the foothold and main market are accessible, meaning that it is just slightly disabling for disruption (-1).

3. Customer attraction - does the value proposition create a relative advantage compared to incumbents?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Price (interest rate to borrow money)	0	3	0
Yield/Return of investment (for investors)	+3	3	+9
Risk (for investors)	-1	3	-3
Loan amount	-1	2	-2
Access to capital	+3	3	+9
Creditworthiness requirement	+1	3	+3
Flexibility	+2	1	+2
Averages		Average weight = 2.57	Average score = 2.57
Normalized score = +1.0			

With a normalized stage score of +1.0, P2P lending and Debt crowdfunding are expected to provide an increased value proposition relative to the insurgent. The price for borrowing money, the interest rate, is generally higher than the interest rate offered by banks, which is considered less attractive and disabling for disruption. The cost structure is different for P2P lending and Crowdfunding than for traditional banks. There are lower costs for these platforms since there are direct channels, where intermediaries can be eliminated, and automated customer relationships. Thereby the interest rates can be more attractive to borrowers compared to credit card loans but it is still higher than banks (0). The yield for investors is significantly higher than the traditional deposit rate from banks due to the different cost structure of the platform, meaning enabling for disruption (+3). Higher yield is however related to a higher risk for investors, but it can be managed through spreading their investments, thus it is only slightly disabling for disruption (-1). The loan amount offered might be an important factor for borrowers, and the amount provided by these P2P platforms is generally lower than the amount from traditional banks. The relatively low loan amount limit on the P2P lending platforms makes it less attractive. However, there are no limits for the borrowers in Debt crowdfunding and it is therefore slightly disabling for disruption (-1). P2P lending and Debt crowdfunding facilitates access to capital for individuals and businesses that previously have not been able get funding due to low creditworthiness (+3) and it is therefore an important factor to attract customers. The requirement for creditworthiness to borrow money is very influenceable and the requirements to borrow from a P2P or crowdfunding platform are lower than for borrowing from a bank. However, requirements exist which makes it a factor that is just slightly enabling of disruption (+1). Although flexibility is not a very influenceable factor, P2P lending and Debt crowdfunding is more flexible for investors since these are allowed to choose to whoever they are lending money to. It is therefore a factor enabling for disruption (+2).

4. Customer switching - how easily can customers switch from incumbents to the insurgent?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Compatibility	+1	2	+2
Complexity	+3	2	+6
Trialability	+1	1	+1
Observability	+3	3	+9
Averages		Average weight = 2	Average score = 4.5
Normalized score = +2.25			

Customers can easily switch from the incumbent to the insurgent, which is shown in the normalized score of 2.25. The compatibility for P2P lending and Debt crowdfunding is relatively high, users does not have to be retrained to a large extent. One can argue that investors have to learn to manage their own risk and that borrowers need to apply through pitching, but the process for investors and borrowers is very similar to traditional ones, making it a factor enabling for disruption (+1). The concept of P2P lending and Debt crowdfunding is not complex, it is basically small contributions from a large amount of people. We argue that complexity is an important factor in terms of lending, and since the complexity is low it is a factor enabling switching and thus disruption (+3). For investors it is easy to try P2P lending and Debt crowdfunding since these are allowed to invest very small amounts of money. For borrowers it is however slightly more difficult since these need to be approved and create a pitch, making the trialability a factor slightly enabling for disruption (+1). Since P2P lending and crowdfunding sites present interest rates, yields, investment opportunities and emphasize the risk-return tradeoffs, the observability is considered to be high, thus enabling for disruption (+3), and an important factor for customers to decide whether to switch or not.

5. Incumbent retaliation - does the incumbents have high barriers to retaliate against the insurgent?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Incumbents awareness of insurgents	-3	1	-3
Need of different business model	+2	1	+2
Incumbent's cost of retaliation	-3	3	-9
Need of adding core competencies	-3	2	-6
Averages		Average weight = 1.75	Average score = -4.0
Normalized score = -2,29			

The normalized stage score -2.29 indicates that the incumbents have low barriers to retaliate. Banks are highly aware of P2P lending and crowdfunding platforms, which is considered disabling for disruption (-3). Just being aware of an insurgent is however not that influenceable since it automatically does not imply retaliation. In order to compete with an insurgent offering loans to an underserved segment and offering higher yields for investors, banks would have to change their business model in terms of value proposition, cost structure, revenue model, channels and customers relationship. This indicates a barrier for retaliation and enabling for disruption (+2). They would have to compete through either offering loans to borrowers that has previously not been perceived to be creditworthy and/or attract investors with higher yields or a better customer experience. However, the cost for banks to retaliate is very low considering that these have the resources for creating their own platforms, which implies a low barrier for retaliation and disabling for disruption (-3). Additionally, since a bank's core competency is to manage risk there is no need for adding additional or replacing existing core competencies, which implies a low barrier for retaliation and thus disabling for disruption (-3).

6. Incumbent displacement - does the innovation displace (as opposed to augment) incumbent service and revenues?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
The innovation will impact incumbents in current market	+2	3	+6
The innovation will affect incumbents in future markets	+3	3	+9
Averages		Average weight = 3	Average score = 7.5
Normalized score +2.5			

The normalized stage score is +2.5, meaning that P2P lending and Debt crowdfunding have the potential of displacing the incumbents' services and revenues. As mentioned in the first step in this test, P2P lending and Debt crowdfunding target a market segment of borrowers that at the moment is not included in the bank's core business offering. However, the market for P2P lending and Debt crowdfunding is predicted to reach $290 billion and $90 billion respectively in 2020, and one can then argue that investors might change from banks to P2P lending and Debt crowdfunding markets. The impact on incumbents in the current market is relatively small at the moment but is likely to increase in the future, thus enabling for disruption (+2). Furthermore, Hernandez et al. (2015) argue that the P2P lending model is expanding from consumer loans to other types of loans, such as mortgages, which indicates that it also might impact incumbent in these future markets, hence enabling for disruption (+3).

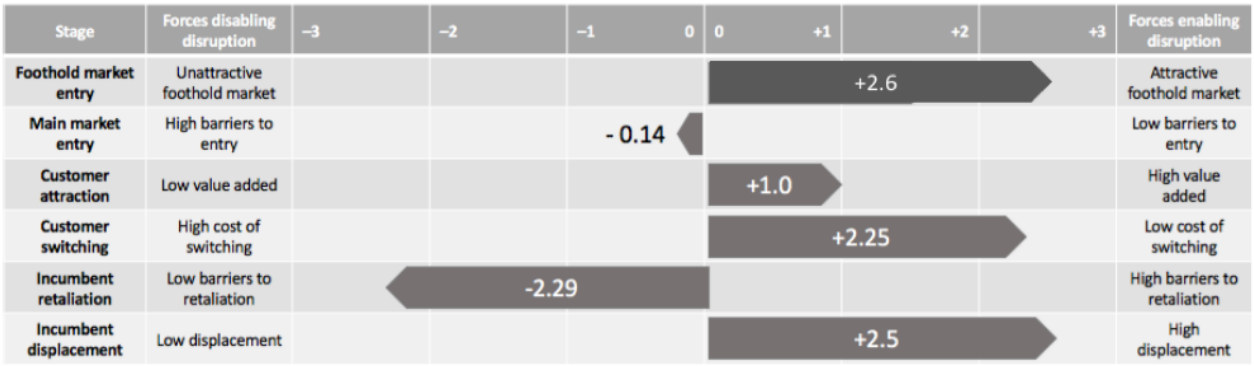

Figure 24. Disruptiveness profile for P2P lending and Debt crowdfunding

Incumbents in the fixed-income market should expect insurgents to get a foothold since there are no factors disabling and one or more strongly enabling for foothold entry (+2.6). Looking at the barriers of the main market it is difficult to tell whether entry can be expected or not (-0.14). Although in favor of low capital requirements, P2P lending and Debt crowdfunding platforms are highly dependent on approval from Finansinspektionen and in need of network effects to successfully enter the main market. Since it is difficult to determine whether the barriers are high enough, incumbents must monitor the situation closely over time. If network effects and/or approvals from Finansinspektionen could be acquired more easily for some reason, entry on the main market is likely and vice versa. Further, insurgents managing to enter the main market may provide higher customer value than incumbent services (+1.0), and customers can easily switch from the incumbent to the insurgent (+2.25). Since there are no factors significantly disabling but several strongly enabling factors for disruption it means that incumbents must take action. This is further emphasized since it does not seem to be any barriers for the incumbent to retaliate (-2.29), and displacement in the current market and future markets may be high (+2.5).

According to this analysis, insurgents managing to enter the main market and managing to provide sufficient customer value might disrupt incumbents that does not retaliate. The results from the test shows an average of +0.99, meaning that P2P lending and Debt crowdfunding has potential of disrupting the fixed-income market.

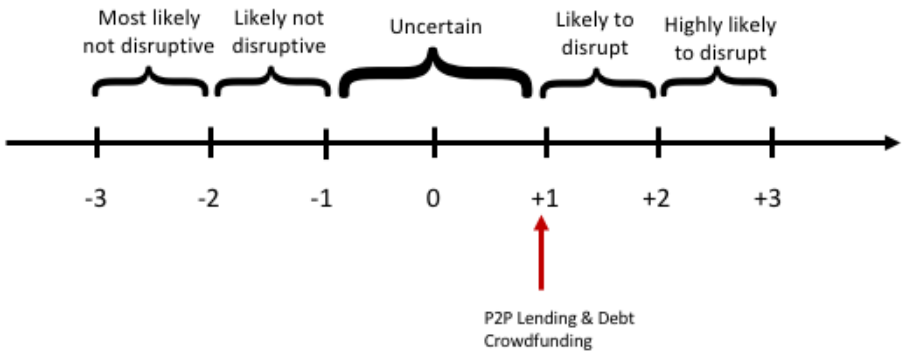

Figure 25. Disruptiveness score for P2P lending and Debt crowdfunding

8.2 Equity crowdfunding

In the analysis of Equity crowdfunding, the incumbents can be defined as the actors providing functions that might be replaced with an Equity crowdfunding platform. These could be the equity market's traditional marketplaces such as stock exchanges or Multilateral Trading Facilities (MTFs). An incumbent can also be a venture capital (VC) firm or a business angel (BA) since these are common sources of capital for ventures. Equity crowdfunding has emerged as a way for ventures to raise capital without a stock exchange or a MTF and without support from VCs and BAs. It is therefore an alternative for ventures that are too small to issue shares on a stock exchange or a MTF and that has been denied or do not want funding from a VC firm or BA.

1. Foothold market entry - can the insurgent gain a foothold (usually in the market below the main one)?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Targets populations who historically lacked skill or money to buy	+3	3	+9
Underserved segments	+3	3	+9
Insurgents presence in the foothold market	+1	2	+2
Averages		Average weight = 2. 67	Average score = +6.67
Normalized score = +2.50			

The normalized stage score for the foothold market is +2.50, meaning that insurgents most likely can gain or already have a foothold in the market. Equity crowdfunding generally targets a customer segment of ventures that have been rejected since they did not meet the requirements to access funding (+3). However, this is not always the case considering that companies that are able to issue shares on a stock exchange or a MTF can still choose Equity crowdfunding instead. On the investor side, Equity crowdfunding targets anyone that want to invest or contribute with their knowledge in a venture.

Ventures turning to Equity crowdfunding can be considered an underserved segment (+3), since their first choice would probably be to issue their shares directly on a stock exchange, a MTF or go directly to VCs or BAs. But once again, ventures might turn to a crowdfunding platform without having been rejected. Additionally, Equity crowdfunding might also target investors that has not previously been able to contribute with their knowledge in a venture due to lack of capital for influencing an established firm, which also can be seen as an underserved segment. Furthermore, although Equity crowdfunding is relatively small compared to other types of crowdfunding, there are actors such as Crowdcube and FundedByMe established in the foothold market (+1).

2. Main market entry - does the insurgent face high barriers to enter the main market?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Network effects	-2	2	-4
Capital requirements	+3	2	+6
Formal institutions - Government policies, laws, regulations, rules	-1	3	-3
Averages		Average weight = 2.33	Average score = -0.33
Normalized score = -0.14			

Since Equity crowdfunding already got a foothold in the market, the question is whether it can overcome the barriers and enter the main market and become an alternative to a stock exchange or MTF, as well as an alternative to approach VCs or BAs. As for P2P lending there is a need for network effects, it needs to be attractive investment opportunities on an Equity crowdfunding platform in order to attract investors and there need to be investors to attract new ventures (-2). One can argue that it historically has been costly to develop an intermediary of securities and that capital has been a key resource, while the new way of Equity crowdfunding is relatively cheap due to that only an internet platform is needed (+3). Furthermore, platforms need to have permission from Finansinspektionen to perform their services according to the Swedish Securities market act. However, there are several companies such as FundedByMe and Crowdcube that has got this approval, which indicates that the obstacle is manageable, thus only slightly disables disruption (-1). This results in a normalized score of -0.14, which indicates that it is hard to decide whether Equity crowdfunding will enter the main market or not.

3. Customer attraction - does the value proposition create a relative advantage compared to incumbents?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Excess functionality in incumbent service	+1	2	+2
Yield/Return on investment (for investors)	0	3	0
Risk (for investors)	-1	3	-3
Access to capital	+2	3	+6
Averages		Average weight = 2.75	Average score = 1.25
Normalized score = +0.45			

The score of +0.45 for customer attraction indicates that an Equity crowdfunding platform offer a slightly greater value proposition to the customers. Regarding the functionality of Equity crowdfunding, it slightly decreased for investors in terms of alternatives where to invest. Investors are however allowed to take part of a venture to a greater extent than at a stock exchange or MTF

due to that ventures generally are smaller. Further, VC firms can use Equity crowdfunding platforms as additional opportunity to identify potential investment targets. There is also additional functionality for ventures. By launching a campaign on an Equity crowdfunding platform ventures are allowed to test their business ideas and use the results as support when applying for investments from established institutions, and it can also be used for exposure and marketing early in a company's lifetime. A venture can, however, not expect the crowd to contribute with the same expertise as a professional VC firm or BA. Altogether, the additional functionality of Equity crowdfunding is slightly enabling for disruption (+1) and it is a somewhat influenceable factor considering that ventures are generally looking for more than funding.

The return on investment is an important factor for investors and thus for customer attraction. Deciding the return is however dependent on each and every venture, which makes it difficult to state whether it is higher or lower than on a stock exchange or MTF (0). The risk for investors is also an influenceable factor. Although the risk level with respect to VCs and BAs is basically the same, it is higher compared to a MTF since ventures generally are more risky than more mature companies (-1). As for return on investment, the risk is of course dependent on each and every venture.

One can argue that Equity crowdfunding is another chance of getting access to capital for ventures that are too small for a stock exchange or MTF and that already have been rejected by VCs and BAs. This is very valuable for a venture considering it could be the difference between succeeding or not (+2). Whether these would get access to capital or not is of course dependent on the business idea and how it is presented.

4. Customer switching - how easily can customers switch from incumbents to the insurgent?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Compatibility	+2	2	+4
Complexity	+3	2	+6
Trialability	+3	1	+3
Observability	-1	2	-2
Averages		Average weight =1.75	Average score = +2.75
Normalized score = +1.57			

The normalized stage score for customer switching is +1.57, meaning that it is quite easy for customers to switch from the incumbent to the insurgent. Although the risk level might differ from a stock exchange or MTF, the compatibility for investors is considered to be high (+3) since it is the same basic principle. The compatibility is also high for ventures, which still have to attract investors. The complexity is considered to be low, since it is not difficult to understand how the Equity crowdfunding model works; investment in return for equity. It is thus enabling for disruption (+3).

Ventures are generally charged with a significant fee for launching a campaign. However, this fee is very low compared to the cost of an Initial Public Offering (IPO) meaning that their trialability is rather high. There are no launching fees for investors, meaning that their trialability is even higher, ultimately resulting in trialability as a factor enabling disruption (+3). Regarding observability, the platform providers are eager to show success-cases but the results from investing in a specific venture is relatively hard to establish since it is difficult to estimate whether an investment would be successful or not. A stock exchange or MTF is generally more stable due to the maturity of the listed companies, meaning that the lack of observability is slightly disabling for disruption (-1).

5. Incumbent retaliation - does the incumbents have high barriers to retaliating against the insurgent?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Incumbents awareness of insurgents	-3	1	-3
Incumbent's cost of retaliation	-3	3	-9
Need of adding core competencies	-3	2	-6
Averages		Average weight = 2	Average score = - 6
Normalized score = -3			

The normalized score for incumbent retaliation is -3, meaning that there are basically no barriers for incumbents to retaliate. The incumbent in this case is a stock exchange or MTF and perhaps also VC firms to some extent. VCs are however able to use the platforms for both identifying and investing in ventures, reducing their need for retaliating. Actual retaliation for a stock exchange or MTF against Equity crowdfunding platforms would be offering listing for ventures. Considering that Equity crowdfunding is commonly known, incumbents are most likely aware of potential insurgents meaning that awareness is not a barrier for retaliation, thus disabling for disruption (-3). The cost for incumbents to retaliate is low (-3), and thus disabling for disruption. It would probably not cost that much to offer listing for ventures in addition to already listed companies. However, one can argue that it might affect the quality of the stock exchange since it is not uncommon that ventures fail. Further, there is no need for incumbents to add additional core competencies to retaliate (-3).

6. Incumbent displacement - does the innovation displace (as opposed to augment) incumbent service and revenues?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
The innovation will impact incumbents in current market	+1	3	+3
The innovation will affect incumbents in future markets	+1	3	+3
Averages		Average weight = 3	Average score = 3
Normalized score = +1			

The normalized score of +1 means that Equity crowdfunding might displace incumbents in the current and future market. At the moment the stock exchange does not offer investments in the same kind of companies as can be found on an Equity crowdfunding platform. Displacement in the current market will only happen if Equity crowdfunding platforms becomes the first choice for ventures. In order to be the first choice, these platforms must be able to provide the same expertise as VCs, the stock exchange and BAs can. There are however examples of companies, such as Paradox, issuing a part of total shares through Equity crowdfunding platforms, meaning that displacement in the current market is slightly enabling for disruption (+1).

Regarding future markets, those would be some of the other services that a stock exchange or MTF provides such as business valuation, marketing, legal support etc. Equity crowdfunding platforms does not currently offer all those services, but if they would there would be an increased threat of potential disruption (+1).

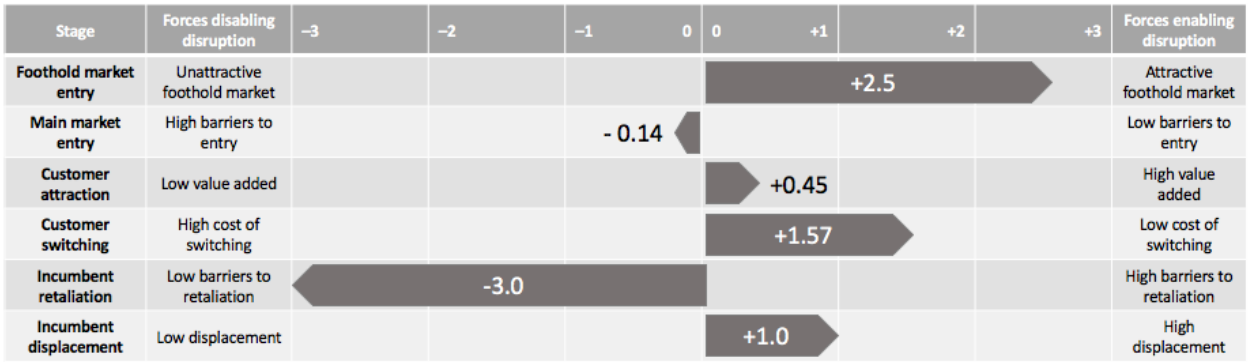

Figure 26. Disruptiveness profile for Equity crowdfunding

The equity market should expect Equity crowdfunding to get a foothold since all contributing factors are positive and thus enabling for disruption (+2.5). It is more difficult to tell whether there are barriers that surround the main equity market since there are factors both enabling as well as disabling disruption (-0.14). Thus, entry on the main market is possible but not certain. If the insurgent manage to enter the main market it may provide more value for the customers than the current solutions on the market (+0.45). It is also relatively easy for customers to switch to Equity crowdfunding due to high compatibility, low complexity, and high trialability (+1.57). However, the incumbents are able to retaliate since they have the required resources in order to do so (-3) and they can expect a slight displacement (+1). To summarize, there are many factors in favor of disruption but an average number would result in +0.39, which indicates that it is hard to decide whether the technology is disruptive or not according to Rafii & Kampas (2002) reasoning.

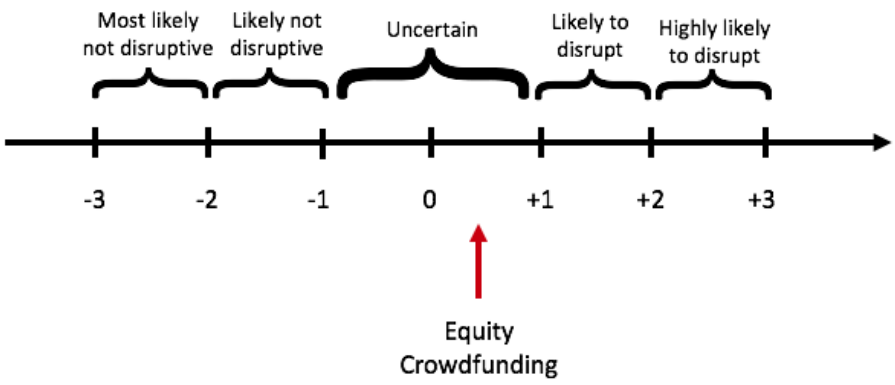

Figure 27. Disruptiveness score for Equity crowdfunding

8.3 Peer-to-peer currency exchange

In the analysis of P2P currency exchange, the insurgents are platforms such as CurrencyFair and Transferwise, while the incumbents can be seen as traditional banks and their systems for currency exchange. P2P currency exchange did not emerge through a foothold market but did instead enter the main market directly and targets the same customer segment as traditional currency exchange services. Hence, analyzing the potential foothold and main market entry is irrelevant for deciding the disruptiveness of P2P currency exchange. It is more interesting to analyze the customer attraction.

3. Customer attraction - does the value proposition create a relative advantage compared to incumbents?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Price	+3	3	+9
Supply of currencies	-1	2	-2
Counterparty risk	0	3	0
Speed	0	2	0
Averages		Average weight = 2.5	Average score = +1.75
Normalized score =+0.7			

The normalized stage score is +0.7, meaning that P2P currency exchange may offer a greater value proposition to customers than traditional currency exchange through banks. They provide the same value to customers, exchange of currencies, but at a lower price. When, choosing between different ways to exchange currencies, the price can be considered an important factor and can in some cases be the decisive factor. The price for a currency exchange with Transferwise is 0.5 percent and according to Transferwise (2016) and CurrencyFair (2016) a customer can save up to 90 percent by using their service compared to traditional banks. Hence, they got a relative advantage in price (+3) but at the same time they have a quite low supply of currencies (-1). Transferwise offer 16 currencies

to trade and CurrencyFair offer 18 currencies to trade, and three additional that is possible to buy. However, they have the most common currencies, which alleviates their lack of supply.

As for traditional currency exchange offered by banks, a P2P currency exchange platform reduces the counterparty risk (0) by using Payment versus Payment (PvP) to trade the currencies at two accounts on the platform. Thereby, they do not need to use Continuous Linked Settlement (CLS) for this purpose, which is a reason for the different cost structure with lower costs and thereby also lower prices for customers. Furthermore, P2P currency exchange platforms use direct channels between the investors and borrowers, where intermediaries are eliminated, and automated customer relationships, which contribute to the lower cost structure and therefore also lower prices. The P2P currency exchange platform providers argue that their service is faster compared to traditional transfers. The duration of transfers is however dependent on currency and payment method, making it difficult to decide whether it is actually faster than a traditional transfer. Hence the speed is set to neither enable nor disable disruption (0).

4. Customer switching - how easily can customers switch from incumbents to the insurgent?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Compatibility	+2	1	+2
Complexity	+1	2	+2
Trialability	+3	2	+6
Observability	+3	2	+6
Averages		Average weight = 1.75	Average score = +4.0
Normalized score = +2.29			

The normalized stage score for customer switching is +2.29, meaning that it is easy for customers to switch from banks to P2P platforms for currency exchange. The service is highly similar to current currency exchange services. Users do not have to familiarize themselves with new functions and thus the compatibility is high and enabling for disruption (+2). The transfer process is simple and does not involve any third parties. Thus, one can argue that the complexity for P2P transfer is slightly lower than for traditional currency transfers, making it somewhat easy to switch to and slightly enabling of disruption (+1). Further, since it is possible to test the service without major implications the trialability is high, and therefore enabling for disruption (+3). Additionally, users are allowed to compare the benefits such as rates and processing time between P2P platform transfers and traditional ones, making the observability high and enabling for disruption (+3).

5. Incumbent retaliation - does the incumbents have high barriers to retaliate against the insurgent?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Incumbents awareness of insurgent	-3	1	-3
Incumbents cost of retaliation	-1	3	-3
Need of adding core competencies	-3	2	-6
Need of new business model	+2	1	+2
Product, architecture, and competency destruction	+2	2	+4
Averages		Average weight = 1.8	Average score = -1.2
Normalized score = -0.67			

The normalized stage score for incumbent retaliation is -0.67, meaning that there relatively low barriers for an incumbent to retaliate. Banks are highly aware of P2P currency exchange platforms, meaning that awareness is not a barrier for retaliation and thus disabling for disruption (-3). The barrier for retaliating through offering their own P2P platform with respect to cost is relatively low, banks possess the resources for creating their own platforms and it is therefore disabling for disruption. The cost of retaliating through using their existing system would however be higher since banks would have to reduce their fees to compete (-1). Since banks are very familiar with currency transfer services there is no need for additional core competencies to retaliate, which is disabling for disruption (-3). One can argue that banks' business models are obsolete and needs to be changed, either through offering their own P2P platforms or through being more transparent and cheaper. This is a barrier for retaliation and somewhat enabling for disruption (+2). If banks would provide their own P2P platforms for currency exchange it would be destroying existing architecture such as CLS and third parties would not be needed. This is a barrier for retaliation and therefore enabling for disruption (+2). However, competing with current systems would not imply any destruction, and thus not imply any barrier for retaliating.

6. Incumbent displacement - does the innovation displace (as opposed to augment) incumbent products and revenues?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Amount of displacement in current markets	+3	3	+9
Amount of displacement in future markets	0	3	0
Averages		Average weight = 3	Average score = +4.5
Normalized score = +1.5			

A normalized score of +3 for incumbent displacement means that incumbents in the foreign exchange market should expect displacement and start acting immediately. Currency exchange is an important revenue source for banks, and since P2P currency exchange providers already are present in the main market, and although their aggregated market share is less than 5%, the displacement in the current market is expected to increase according to Mantel (2015). Thus, disruption is highly enabled (+3).

Considering that P2P currency exchange providers handle deposited money these would perhaps be able to provide other traditional banking services such as lending. In order to do so these would however need to be regulated differently, having to provide a capital buffer, which would impose a high barrier of entry. One can argue that giving up their main advantage of low capital requirements is highly unlikely and therefore neither enabling nor disabling for disruption (0).

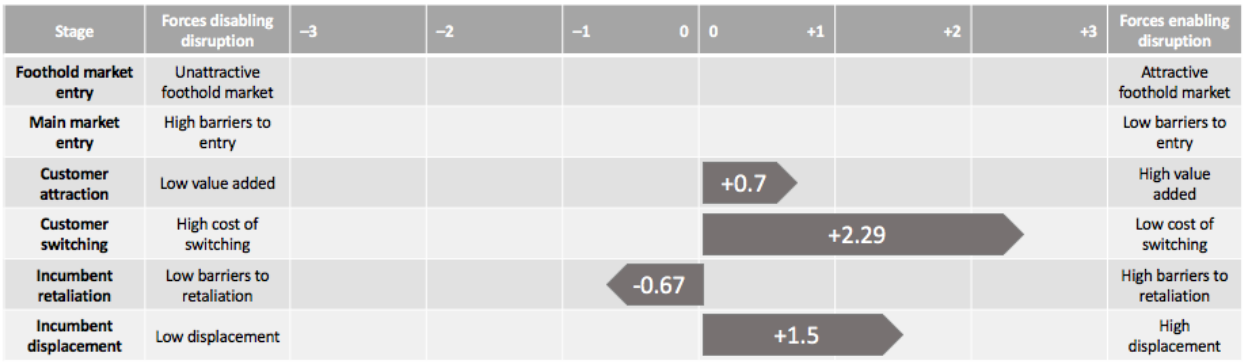

Figure 28. Disruptiveness profile for P2P currency exchange

P2P currency exchange is cheaper, easy to use and cover the same counterparty risk as traditional services. The value proposition is thus expected to be slightly higher than traditional services (+0.7), meaning that incumbents should be aware of a possible threat. If supply of currencies increases and faster transfers can be assured for P2P currency exchange, customer value would increase and incumbents must then take action. In addition, it is very easy for customers to switch into using P2P currency exchange (+2.29), and there are some barriers for retaliating (-0.67). Incumbents got the financial resources for retaliating and are aware of the insurgents. Although, they may need new business models for retaliating and perhaps existing system architecture would be obsolete. Furthermore, displacement might happen (+1.5). According to Rafii & Kampas' (2002) framework, P2P currency exchange might disrupt the currency exchange market since the average score from the test is +0.96.

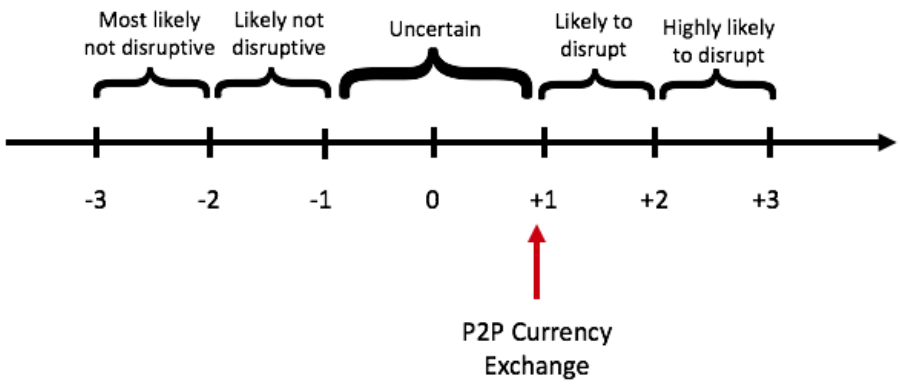

Figure 29. Disruptiveness score for P2P currency exchange

8.4 Blockchain technology for payments

For the analysis of potential disruptiveness for Blockchain technology within payments, the insurgent is defined as the actual Blockchain technology and the incumbent is the traditional payment infrastructure. The foothold market for the Blockchain technology is the Bitcoin market, where it was invented. The technology is well established in the market for Bitcoin and it is therefore more interesting to look into a possible entry in the main market of payments. However, Companies such as Ripple and Chromaway are already providing blockchain payment solutions. This implies that the technology already is established in the main market. The question is then whether it will attract customers and make them switch from traditional payment providers to a Blockchain solution.

3. Customer attraction - does the value proposition create a relative advantage compared to incumbents?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Excess functionality in incumbent service	+1	1	+1
Speed of payment	+3	3	+6
Price	+3	3	+6
Safety & reliability	+2	3	+6
Averages		Average weight = 2.5	Average score = 4.75
Normalized score = +1.9			

The normalized stage score for customer attraction is +1.9, meaning that the Blockchain technology offer customers a greater value proposition than current incumbent systems. One can argue that if an implementation benefits end consumers of the payment services it will also benefit banks, and vice versa. Hence, the value the technology brings are analyzed from both a bank's and end consumers' point of view. Blockchain technology provides additional functionality such as micropayments, something that has not been possible before and will facilitate new types of revenue models (+1).

As Nakamoto (2008) describes it, a Blockchain based transaction is done through direct channels directly between two parties, which eliminates the need for an intermediary. They will not be needed to manage the "double spend problem" either. As described in chapter 4, there is often a time lag due to involvement of third parties in payments between different banks. The current payment process involves liquidity verification in order to carry out the payment. This is something that is not necessary with a Blockchain payment, hence the first step in a transaction between different banks is unnecessary. Since the Blockchain is transparent and every transaction that has ever been made can be seen, the amount in every account is calculated automatically and the liquidity verifications is therefore not necessary. Furthermore, the payments on a Blockchain do not need to go through a bank or the central bank and the settlement system in the central bank is not needed. This implies that Bankgirot, which collect information about size of the transactions and to what account they are being transferred and communicate it to the banks, might not be needed in a Blockchain based payment solution. Since, many third parties and steps in the payment process is not needed in a Blockchain solution, the payment process is much faster (+3). Besides making the payments faster, it creates a different cost structure with lower costs due to less involved parties and more efficient processes, which results in lower prices for customers (+3). Bogart and Rice (2015) argue that merchants can save up to 90 percent by carrying out payments on a Blockchain instead of in their current systems. Furthermore, the cost of a payment will dramatically decrease for international payments since they are as cheap as domestic payments.

The CLS, which is described in chapter 4, was introduced to reduce the risk due to the time lag that occurs when a currency trade is made between two accounts in different countries. Since the process of a payment will be faster through a Blockchain, the need of CLS might also be questioned.

The safety can be considered to be higher with a payment solution based on a Blockchain (+2), since it is completely transparent and every transaction can be seen, no financial information needs to be disclosed and the double spend problem no longer exists. There are other problems that occur with a Blockchain such as if a mining pool gets 51 percent of the computing power or if the private key is exposed or stolen. However, the most likely scenario is that the banks will develop permissioned ledgers, which means that they will be responsible for the verification and thereby eliminate the 51 percent problem. They will also most certainly require every participant to identify themselves, using e.g. bank id, when opening an account, which means that they can connect an account to a specific person, which is useful in case of theft. Hence, a Blockchain will create a safer payment process if it is possible to manage the challenges.

4. Customer switching - how easily can a bank switch to a Blockchain payment solution?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Challenge of switching & Compatibility	+1	3	+3
Complexity	0	1	0
Trialability (Rogers)	-3	3	-9
Observability (Rogers)	-2	3	-6
Informal institutions - resistance to change	+1	2	+2
Averages		Average weight = 2.4	Average score = -2
Normalized score = -0.83			

It is not that easy for a bank to switch from a current payment system to a system based on a Blockchain, which is showed in the normalized score of -0.83. There are several challenges and low compatibility if a bank want to change and replace their existing systems, which according to Lüning & Sundström (2016) are outdated. They further argue that there are operational risks when running parallel or shifting the infrastructure. However, there are other solutions like Ripple's and Earthport's that are available on the market and allowed to be implemented with high compatibility to existing infrastructure. Ripple states that its solution is "architected to fit within your bank's existing infrastructure, resulting in minimal integration overhead and business disruption" and Earthport states that their "platform plugs directly into our client's existing infrastructure to provide seamless integration with multiple options for connectivity, technology and file-formats". The compatibility is an important factor and would be very low if the banks chose to develop their own infrastructures but since there are solutions available on the market that can easily be implemented, the compatibility is considered to enable disruption (+1).

The Blockchain technology is quite complex but there would most likely be cooperations and partnerships, like Distributed Ledger Group (DLG), where technology experts are involved (Buhler et al. 2015; Frøystad & Holm, 2015). The banks are already used to complex systems and one can argue that it will be perceived as less complex for them (0).

Furthermore, the trialability of the technology seems to be very low (-3) due to the fact that the largest banks in the world need to cooperate and since they must build a completely new infrastructure in order to test it. The observability can also be considered low (-2). Blockchain providers present use cases, but since the technology is still under development and testing, the final result is hard to determine. Furthermore, Crosby et al. (2015) explains that there is often a resistance to change that needs to be managed in order to implement the technology. However DLG, is an obvious initiative for change and proof that there is a willingness to change (+1), and thus enabling disruption.

The incumbent retaliation step of the analysis for Blockchain within payments is not relevant since the most likely scenario seems to be a cooperation between blockchain solution providers and banks (Buhler et al. 2015; Frøystad & Holm, 2015). The banks will most likely not try to improve their current system in order to compete with a working Blockchain solution, but instead cooperate with it. The strong benefits of being interconnected implies that there will be no retaliation from the banks.

6. Incumbent displacement - does the Blockchain displace incumbent services and revenues?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
The innovation's impact on incumbents in current markets.	+3	3	+9
The innovation's impact on incumbent in future markets /	+3	3	+9
Averages		Average weight = 3	Average score = 9
Normalized score = +3			

The normalized stage score for the last step is +3, meaning that incumbents can expect the current infrastructure to be displaced. If a joint implementation proves to be successful and the benefits from the Blockchain (presented in stage 3) can be realized, it is likely that the Blockchain will fully replace or partly replace the current payment system and remove the need of many third parties and system. Thus, it will have potential for high impact on incumbents in the current market of payments (+3). Furthermore, the Blockchain technology is predicted to be applicable within several different areas of the financial system. Hence a possible high impact in future markets such as transaction of securities, insurance, smart contracts and smart properties (+3).

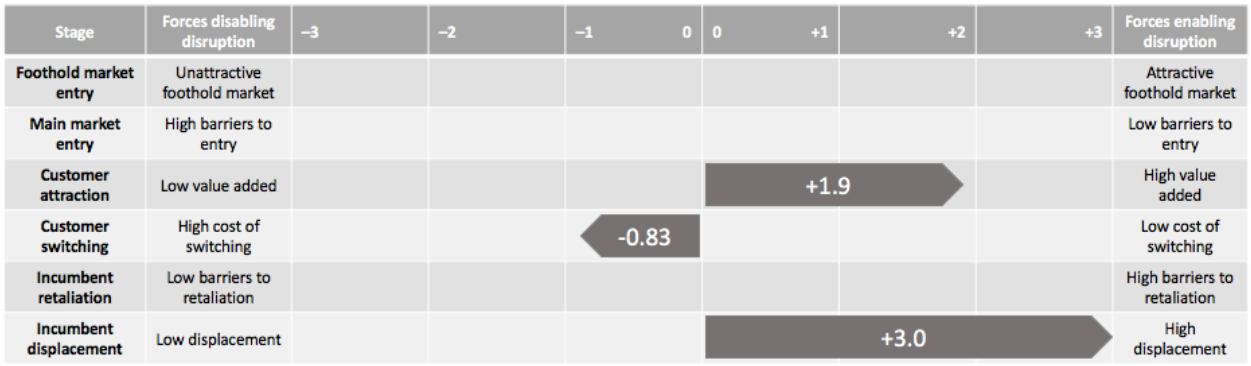

Figure 30. Disruptiveness profile for the Blockchain technology for payments

To summarize, the Blockchain technology is already present in the foothold as well as the main market for payments. Moreover, the technology can be expected to create a lot more value for customers since every factor is enabling or strongly enabling for disruption (+1.9). However, it might be difficult for banks to switch from the current system to a payment solution based on the Blockchain technology since trialability and observability is disabling for disruption (-0.83). Though, the technology can be expected to displace current payment system and impact both the current and

future markets (+3). To summarize the analysis gives an average score of +1.36, which according to Rafii & Kampas (2002) framework, indicates that disruption is likely to happen.

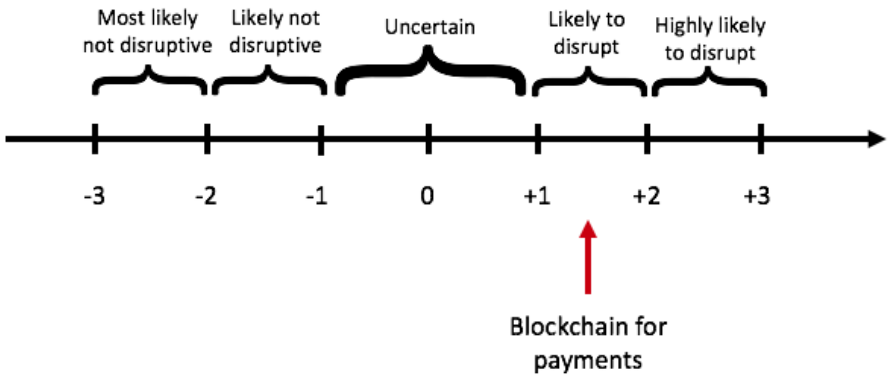

Figure 31. Disruptiveness score for the Blockchain technology for payments

8.5 Blockchain technology for issuance and transaction of securities

In the analysis of the Blockchain technology issuance and transaction of securities, the insurgent can be defined as a Blockchain stock exchange and the incumbent as a traditional marketplace such as a stock exchange or MTF. As for Blockchain in payments, the technology has already got foothold in the market for Bitcoins and the first step will therefore not be analyzed. It has also started to enter the main market with Linq, and the barriers to enter the main market will therefore not be analyzed. However, it has not been tested in full size yet but Fredrik Voss says that if the technology works it will now be fully implemented in the main market.

3. Customer attraction - does the value proposition create a relative advantage compared to incumbents?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Excess functionality in incumbent service	+1	1	+1
Cost	+3	3	+9
Speed of trading	+3	3	+9
Safety & reliability	+3	3	+9
Averages		Average weight = 2.5	Average score = 7
Normalized score = +2.8			

With a normalized stage score of +2.8 for customer attraction, the Blockchain technology can be expected to create significantly greater value proposition. The Blockchain technology can create excess functionalities for a stock exchange (+1). As Fredrik Voss describes it, Nasdaq have developed a stock exchange in Estonia, which will enable digital voting in annual general meeting for shareholders as well as facilitate company registration and public pension registration. However, the major benefits is its efficiency in terms of lower cost structure (+3) and increased speed of trading

(+3), which are factors that are highly enabling for disruption. The reason for the reduction of costs and increasing speed is mainly that a number of third parties and systems can be reduced. As Fredrik Voss explains, no legal intermediaries such as a clearing houses, Central Security Depository (CSD) or book-entry systems is needed since everything is managed through the blockchain protocol. This implies that Euroclear Sweden, which manage the register of everyone's holdings, issued securities and trades, might not be needed and the second step of a security transaction can therefore be eliminated. This complete register will instead be included in the Blockchain and the verification of securities and liquidity will be automated since it is possible to know exactly who owns what at any time in a Blockchain. Also the trading system INET Nordic might not be needed since the order book will be included in the Blockchain. Furthermore, the Blockchain technology has the same advantages and disadvantages regarding safety for transaction of securities as it has for payments. In addition to those, Nasdaq (2015) argue that the settlement risk exposure can be reduced by up to 99 percent due to significantly lower clearing and settlement time. Moreover, since the ledger is totally transparent it is possible to see every transaction that has ever been made, which will decrease the overall risk of trading (+3).

4. Customer switching - how easily can the customer switch from incumbents to the insurgent?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Compatibility	-2	3	-6
Complexity	-1	1	-1
Trialability	-3	3	-9
Observability	-2	3	-6
Resistance to change	+1	2	+2
Averages		Average weight = 2.4	Average score = -4
Normalized score = -1.67			

The normalized score of -1.67 indicates that it can be expected to be quite hard to switch from an existing stock exchange to one based on the Blockchain technology. The compatibility of a Blockchain stock exchange can be considered low (-2) since the whole infrastructure and systems needs to be changed. As described in chapter 6, Nasdaq has developed a completely new stock exchange, Linq, which is based on Blockchain technology and is separated from its current stock exchange. Furthermore, the Blockchain technology can be perceived as complex (-1) but as for banks, one can argue that stock exchanges are used to complex system. They will probably also have key partnerships with technology experts like Nasdaq cooperate with Chain. The trialability is also very low for Blockchain stock exchanges (-3) due to the need to create a completely new Blockchain in order to try it, and since it is still under development and testing the final results are not established. Hence there is also a low observability (-2). Again, the resistance to change are the same as for payments, there are generally a resistance to change but the partnership between Nasdaq and Chain is already established, which is an indicator that Nasdaq are willing to change (+1).

The stock exchanges will most likely not try to improve their current system in order to compete with a Blockchain solution, but instead cooperate with it if it proves to work. Hence, the fifth step, incumbent retaliation, is considered to be irrelevant.

6. Incumbent displacement - does the Blockchain displace incumbent services and revenues in the equity market?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
The innovation's impact on incumbents in current markets	+3	3	+9
The innovation's impact on incumbent in future markets	+3	3	+9
Averages		Average weight = 3	Average score = 9
Normalized score = +3			

Blockchain technology may displace incumbents' services in current and future markets, having a normalized stage score of +3. If Linq proves to be successful Fredrik Voss argues that it will be implemented on large scale worldwide. It has potential to displace the current systems and infrastructures in the current market of stock exchanges over the world because of its reduction of costs and increased speed and safety (+3). Furthermore, the technology is predicted to find application areas in the financial system such as payments, smart contracts, smart property and insurance. It will therefore have high impact on incumbents in these markets (+3).

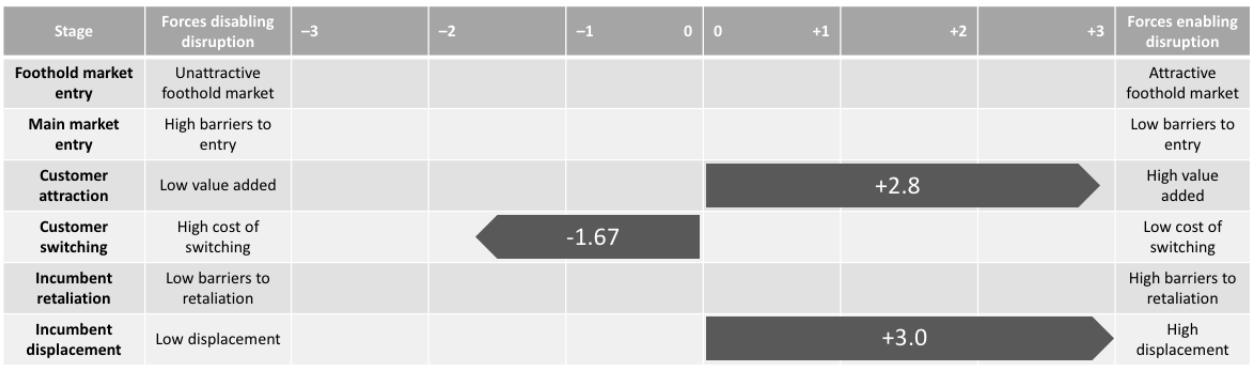

Figure 32. Disruptiveness profile for the Blockchain technology for issuance and transaction of securities

To summarize the analysis of Blockchain technology for transaction of securities, it is already present in the foothold and main market. It is expected to create significant value for customers since almost every factor is strongly enabling for disruption (+2.8), but the main obstacle is switching to a solution based on a Blockchain since one or more strongly disabling factor exists (-1.67). However, the technology can be expected to displace current systems and have huge impact on current market as well as future markets, where all factors are strongly enabling for disruption (+3). This results in an average score of +1.38, which according to Rafii & Kampas (2002) reasoning, indicates that disruption might happen.

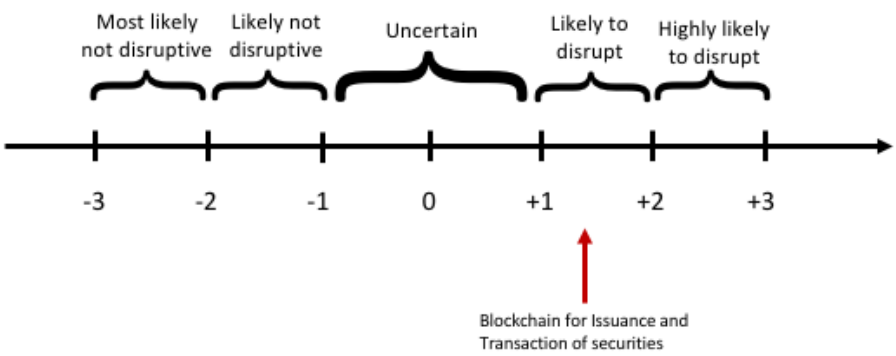

Figure 33. Disruptiveness score for the Blockchain technology for issuance and transaction of securities

8.6 Usage-based insurance

For the analysis of Usage-Based Insurance (UBI), the insurgent is an insurer offering UBI and the incumbent is an insurer that is not. To determine the disruptiveness of UBI we are examining whether the UBI-provider is expected to outcompete their current competition. There is no foothold market for UBI and there are established companies already offering UBI in the main market. Hence, the analysis of barriers to enter the foothold and main market is irrelevant. Instead, it is more relevant to analyze whether UBI will attract customers or not. To expect an adoption of UBI, the end consumers have to be convinced to share their personal data. Customer attraction is therefore analyzed from their point of view.

3. Customer attraction - does the value proposition create a relative advantage compared to incumbents?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Excess functionality in incumbent service	+1	1	+1
Premium price	0	3	0
Convenience in the claim process	+1	1	+1
Insurance coverage	0	3	0
Averages		Average weight = 2	Average score = +0.5
Normalized score = +0.25			

With some uncertain factors, and a normalized score for customer attraction of +0.25, it is difficult to say whether UBI will bring a greater value proposition than current services. In addition to providing the actual insurance, there will be opportunities to provide risk management when a significant amount of data is gathered. Whether this functionality is asked for or not is unclear considering that it is difficult to identify how such advice would benefit a specific individual on beforehand. However, since there is additional functionality it is slightly enabling for disruption (+1). Further, it is stated that the UBI premium will be fairer and thus result in an increased customer

satisfaction. The premium price is an important factor and whether it will be cheaper or not depends on the individual, some will enjoy a cheaper premium while others most likely will receive a more expensive premium. Hence, the potential disruptiveness with respect to price is uncertain (0). The claim process is however expected to be faster and more convenient due to the gathering of timely data, thus slightly enabling for disruption (+1). Finally, the insurance coverage is expected to be the same for UBI as for traditional insurance, resulting in neither enabling nor disabling for disruption (0).

4. Customer switching - how easily can the customer switch to UBI from traditional insurance?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Challenge of privacy	-1	3	-3
Informal institutional challenge: security	-2	3	-6
Compatibility	+2	2	+4
Complexity	+2	1	+2
Trialability	-2	3	-6
Observability	-2	3	-6
Averages		Average weight = 2.5	Average score = -2.5
Normalized score = -1			

It is currently somewhat difficult for customers to switch into UBI from traditional insurance services, as shown in the normalized score for customer switching of -1. As for many other IoT solutions, there is a challenge of privacy when it comes to sharing personal data within insurance. Being able to ensure privacy is of paramount importance for insurers and there is a need for high transparency, making it an important factor. It is identified that willingness to share personal data varies with age, where younger people generally are more willing. One can expect an increased willingness over time with generational change, but as for now the challenge of privacy is somewhat of a barrier for switching and thus slightly disabling of disruption (-1). Similarly for security, there is currently a lack of technological convergence and some devices are not expected to possess the performance to ensure encryption. This factor is highly important and currently makes it more difficult for customers to switch, thus disabling for disruption (-2). The compatibility is however enabling for disruption (+2) considering that the insurer still will provide a service in line with customers' past experience and needs. One can argue that UBI is more complex than traditional insurance, but the end consumer is not required to understand it. Being transparent with which factors that decide the individual insurance premium it can actually be perceived as less complex compared to traditional risk calculation models, making it a factor enabling disruption (+2). There are insurers already providing UBI meaning that it is possible to try it out. The process of signing up for it is however more difficult considering that both implementation of software and hardware is needed to experiment with it meaning that the trialability is somewhat limited and disabling for

disruption (-2). Further, consumers are not really able to see the results of UBI. It would be difficult to understand whether your individual premium would be lowered or not, and whether taking advice from an insurer providing risk management would prove to be beneficial or not is basically impossible to understand beforehand. The observability is low and therefore disabling for disruption (-2).

5. Incumbent retaliation - does incumbents have high barriers to retaliating against the insurgent?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
Incumbent's awareness of insurgent	-3	1	-3
Need of different business model	+1	1	+1
Need of adding core competencies	0	2	0
Product, architecture, and competency destruction	0	1	0
Averages		Average weight = 1.25	Average score = -0.5
Normalized score = -0.4			

The incumbents have medium to low barriers for retaliation, which slightly disable disruption since the test show a normalized score of -0.4. Considering that the IoT is one of the most hyped technologies and that UBI is already provided by some insurers, it is fair to state that incumbents' awareness of UBI is high and thus not a barrier for retaliation (-3). Whether there is a need for a new business model or not depend on how the incumbent would retaliate, making it an uncertain factor. Retaliating through providing an own UBI requires a different revenue model, new key resources and activities for data gathering and management, and key partnerships within the IoT ecosystem. On the other hand, an insurer could also retaliate through the existing business model, meaning no major need for change (+1). The need for additional core competencies is also an uncertain factor, depending on how the incumbent is expected to retaliate. If developing an own UBI there would be a need for technological capabilities such as data management for gathering and deriving value from data, possibly through partnerships. Retaliating using the existing insurance model would however not imply a need for any additional core competencies (0). Further, an insurer retaliating through providing a UBI of its own would need IoT architecture but it would not be competency or architecture destroying since IoT data is expected to be a complement rather than a substitute to existing risk calculation models (0).

6. Incumbent displacement - does the innovation displace (as opposed to augment) incumbent services and revenues?			
Contributing factors	**Rating (-3 to +3)**	**Weight (1 to 3)**	**Weighted score**
The innovation impact incumbents in current markets.	+1	3	+3
The innovation impact incumbent in future markets /	+1	3	+3
Averages		Average weight = 3	Average score = 3
Normalized score = +1.0			

Usage-Based Insurance has had its breakthrough within auto insurance with the car as a kind of platform enabling for convenient sensor application, making auto insurance the current market. Since there are actors already providing UBI for auto insurance there is some impact and thus slightly enabling for disruption (+1). Although less significant, UBI has some penetration within home insurance and life insurance (39% launching initiatives), making these the potential future markets. There is an expected growth for UBI within home insurance and life insurance, which would impact traditional insurance models and thus the innovations impact on the incumbent in future markets is a factor enabling for disruption (+1).

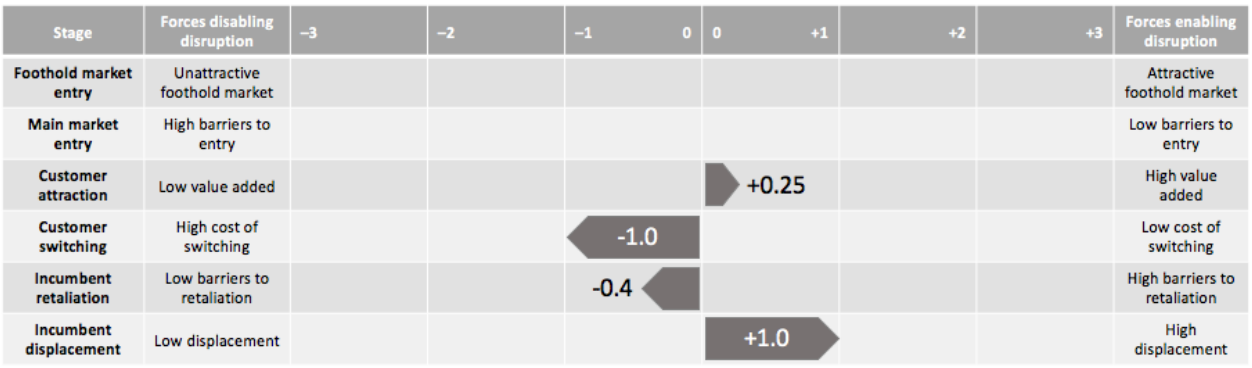

Figure 34. Disruptiveness profile for Usage-based insurance

To summarize the analysis of usage-based insurance, the technology is already present in the main market for insurance. The factors for customer attraction are neither strongly enabling nor strongly disabling for disruption, but will create slightly more value for customers (+0.25). It is quite hard to switch to a usage-based solution due to the privacy challenge, low trialability and low observability (-1). There are no significant barriers for incumbents to retaliate (-0.4) and the technology can be expected slightly displace incumbents since it has some penetration in auto insurance as well as home insurance (+1.0). This results in an average of -0.04, which indicates that it is hard to determine if it is disruptive or not according to Rafii & Kampas (2002) reasoning.

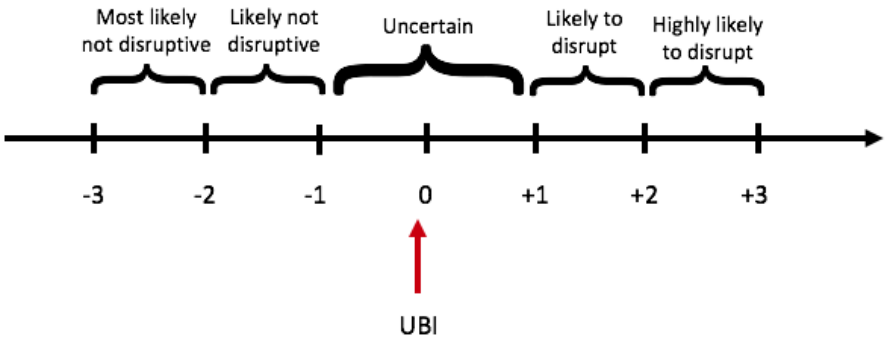

Figure 35. Disruptiveness score for Usage-based insurance

9. Discussion

This chapter involves a discussion, where the results from the analysis are combined with other theories regarding disruptive innovations and empirical data about the innovations, to find out whether the results from the analysis seems to be true and whether the innovations really are disruptive or not.

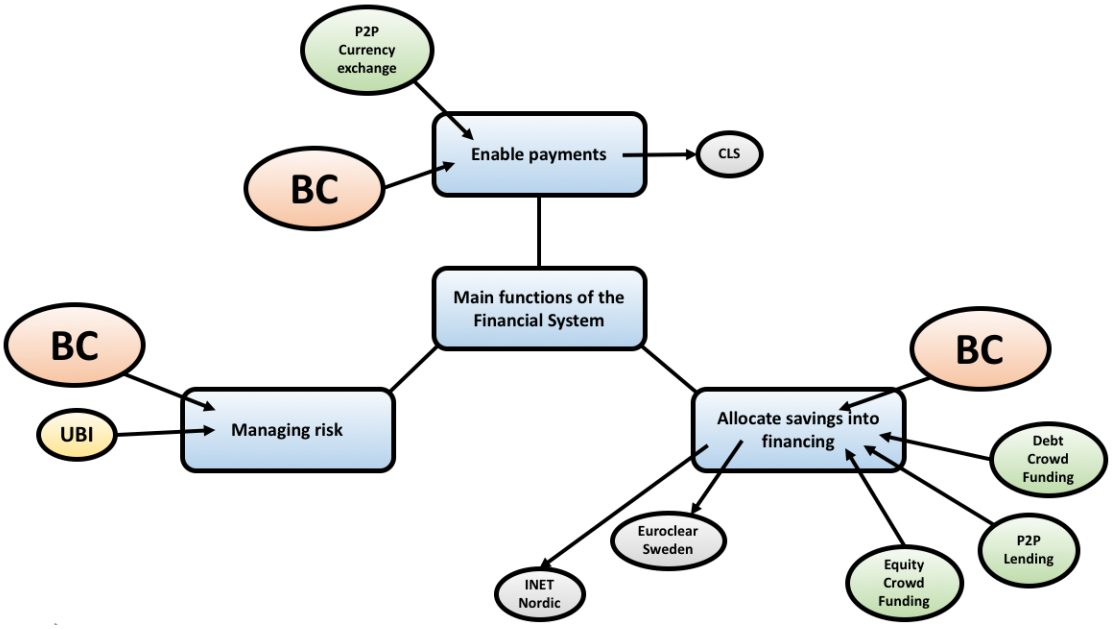

Figure 36. The impact of the emerging innovations in the Swedish financial system

9.1 Peer-to-peer marketplaces; lending, crowdfunding & currency exchange

From the analysis of P2P marketplaces, one can identify that P2P lending and Debt crowdfunding (+0.99), as well as P2P currency exchange (+0.96) got the potential of being a disruptive business model in the fixed-income market and foreign exchange. Whether Equity crowdfunding (+0.39) is a disruptive business model or not for the equity market is however more difficult to decide.

According to Christensen (1997), disruptive innovations generally underperform existing ones, but have features that are valuable for some customers in the existing market as well as a number of customers outside the main market. This support potential disruption for P2P lending and Debt crowdfunding since these might be considered to underperform in the mainstream market due to that the loan amount generally is smaller, the risk is higher, and the interest rate for borrowing is higher. Additionally, P2P lending and Debt crowdfunding have features that are attractive to investors in the main market such as higher yields and higher flexibility, and features such as an increased access to capital that is valuable to customers outside the main market. Christensen et al. (2002) state that a disruptive innovation targets customers who has not been previously able to use a service. This is also true for P2P lending and Debt crowdfunding, allowing individuals and businesses rejected by banks to borrow money.

P2P currency exchange, with potential to be disruptive according to the analysis, has not emerged through a foothold market. It is therefore not targeting customers that have not been able to previously use a service, in contrast to Christensen et al.'s (2002) thoughts about disruptive innovations targeting customers outside the main market. Further, one can see from the analysis that it is not considered to underperform established services. Emerging from lower performance is although not always necessary for being classified as a disruptive innovation (Danneels, 2004). It is however considered cheaper and simpler to use, helping customers to do what they are already trying to do more easily and effectively, which is an indicator of disruption (Christensen, 1997; Christensen et al., 2002). P2P currency exchange seems to fit into an already existing market, targeting customers that are asking for a cheaper and simpler service, meaning that these might be targetable for a disruptive business model according to Christensen et al. (2007). Besides a slightly reduced supply of currencies, it is fair to state that P2P currency exchange is considered "good enough" even though it is simpler and cheaper. Additionally, the business model seems scalable and sustainable, which is another indication of a disruptive innovation (Christensen et al., 2007).

From the analysis of Equity crowdfunding, it is difficult to decide whether it is disruptive or not for the equity market. However, similarly to P2P lending and Debt crowdfunding, Equity crowdfunding is underperforming in the main market in terms of risk for investors and the yield for investors is highly uncertain. Also in favor of potential disruption, Equity crowdfunding is valuable for customers outside the main market, meaning ventures that has been rejected funding, that could get another chance for funding.

One can see that P2P models offer services with possibly higher customer value that customers can easily switch to. Although, there seem to be basically no barriers for incumbents to retaliate against lending- and crowdfunding models, meaning that disruption is unlikely according to Rafii & Kampas' (2002) framework. Meanwhile, barriers for retaliating against P2P currency exchange are expected to be higher. This means that even though the P2P models seem to have the potential of being disruptive for the current lending business model, the actual incumbents are not expected to be disrupted. Furthermore, if banks would retaliate through developing their own P2P platforms, it would just prove the disruptiveness of the business model. Mantel (2015) argue that P2P services will dominate the market and that banks business models are obsolete, considering that the business model and its scalability is proven. The co-founder of Crowdcube, Luke Lang, believes that the P2P models have paramount potential, but that partnerships with traditional financial institutions is more likely than replacing them. Similarly, Daniel Abrahams at CurrencyTransfer believes that banks always will play a part of foreign exchange since these have established trust over many years.

The strong trust that financial institutions generally have, the institutional forces such as norms that individuals are following and have been following for a long time, are in favor for survival of the incumbents. Perhaps these institutional forces can be seen as the incumbents' complementary assets, which according to Tripsas (1997) is what decides whether an incumbent survives or not. Furthermore, Luke Lang's prediction of partnerships with traditional financial institutions is very much in line with what Rothaermel (2001) and Markides (2006) state; that strategic alliances is one

way for incumbents to succeed in times of technological change. Additionally, incumbents starting to offer their own P2P marketplace would be somewhat in line with Christensen's (1997) suggestion to set up an autonomous organization. It would of course depend on the involvement from the main organization. Although incumbents might not be displaced, and although displacement is the final step of Christensen's (1997) process of disruptive innovation, P2P business models might be disruptive anyway, since disruptive business models does not have to take over the majority of the market (Markides, 2006). For example, considering that there is no need for using Continuous Linked Settlement (CLS) with P2P currency exchange, it can most definitely be seen as disruptive from their point of view. This is in line with Danneels (2014) discussion whether a specific technology or innovation is disruptive or not, and his statement that it would be more appropriate to refer to the disruptiveness from a firm's competitive perspective. In this case P2P currency exchange does not seem to be disruptive for banks but for CLS.

In order to realize a full scale displacement there would be a need for an institutional change. Since P2P marketplaces are expected to grow a lot the coming years, these organizations might be able to influence change over time. Further, in the backwater of the financial crisis, traditional financial institutions' reputation are hurt and people are generally more open to alternative financial services. There have already been a formal institutional change, considering that the P2P platforms are legally allowed to exist. The institutional change that is needed for incumbent displacement is more of informal character, and therefore slow moving (Roland, 2004). Currently, it is highly unlikely that P2P lending and Debt crowdfunding platforms will be the first choice for borrowers, nor work as a complete investing platform since investor will require multiple investment opportunities such as stocks, funds, derivatives, currencies etc. and not just lending. Willingness to adopt P2P models seems to vary with age, where younger people are generally more willing to try such services (Morgan Stanley, 2015), meaning that displacement perhaps will increase over generations. Moreover, for Equity crowdfunding, a success story might be needed for additional growth and adoption among investors and borrowers. Additionally, considering that P2P currency exchange is cheaper than traditional services, it might be an economical trigger of institutional change as described by Peters et al. (2005). With significant changes in informal institutions, it might not just be the business models of incumbents that are considered obsolete, but banking as a concept. However, formal and informal institutions might change in the opposite direction. Since P2P lending and Debt- and Equity crowdfunding platforms are relatively new these have never experienced times of recession. It is not obvious that these platforms would survive in such an environment considering that individuals have less capital to invest and tend to avoid high risk investments, which would favor incumbents.

If P2P lending and Debt crowdfunding are disruptive, these will only be disruptive for banks' lending activities. Individuals will still need banks in order to make other investments such as in stocks, funds, derivatives etc. This scenario, where banks lose all their lending activity to these kind of platforms, is however highly unlikely. Hence, P2P lending and Debt crowdfunding seem to be innovations that will complement the bank's services for investors as well as borrowers. In the same way, we believe that most individuals investing in stocks want secure, long-term investments and therefore search for large, stable companies. Hence, these individuals might not be interested in

mainly investing in ventures, which at the moment are the main target of Equity crowdfunding platforms, but would rather invest in companies at Nasdaq OMX Stockholm. Thus, as long as there are only ventures on an Equity crowdfunding platform, it will be seen as a complement to investing at the stock exchanges and MTFs, rather than a disruptive innovation. In order to be more than a complement, Equity crowdfunding platforms must be the first choice for IPOs, and thus being the first choice for investors.

9.2 Blockchain for payments and issuance and transaction of securities

According to Rafii & Kampas (2002) test the Blockchain is likely to be disruptive for one of the main functions in the financial system, payments, as well as for systems, infrastructures and intermediaries in the equity market, since it got the score of +1.36 and +1.38. Furthermore, the argument from Christensen et al. (2002), that disruptive technologies generally are cheaper and more convenient to use, is another sign that the Blockchain is a disruptive technology since it allow for cheaper and more efficient payments and transactions of securities. However, Christensen (1997) state that disruptive technologies are generally underperforming in the mainstream market, which not seems to be the case for Blockchain. Although, Danneels (2004) argues that the technologies does not have to be underperforming and therefore speaks in favor of Blockchain as a potentially disruptive innovation.

Moreover, Christensen et al. (2007) suggest that companies should look for similar but simpler and cheaper alternatives to customer segments that are not being targeted in order to identify a disruptive innovation. The Blockchain may provide a cheaper solution, but it is not considered to target a new customer segment. However, Danneels (2004) question that mainstream customers never initially value disruptive innovations, meaning that the Blockchain might not have to target a new customer segment in order to be disruptive. Additionally, the Blockchain will help users to do what they are already trying to do, but more easily and effectively, which is another indicator of disruptive innovation according to Christensen et al. (2002).

Even though the theory speaks in favor of Blockchain as a disruptive innovation and Nasdaq argue that their Blockchain, Linq, will replace the current system for stocks in private companies, the banks and stock exchanges in the financial system are not expected to be disrupted considering their extensive development efforts within the area. Hence, it might be too radical to say that the Blockchain will disrupt the financial system. There will most certainly be some areas in the financial system being displaced, such as systems like CLS, Bankgirot, INET Nordic and Euroclear Sweden, making the innovation disruptive for those. Furthermore, there are steps in the processes, like the second step in a security transaction that is becoming obsolete.

In order to fully utilize the advantage of the Blockchain, an institutional change might be needed. Brodersen et al. (2016) argue that the early adoption will take place in 2016-2017 and that new rules and regulations will be developed. There are mainly formal fast-moving institutions that needs to be changed, like new laws and regulations regarding the taxation in order to ensure that taxes are being paid. One can argue that the government has incentives to change the formal institutions, in order to

facilitate a Blockchain adoptions, since it will facilitate auditing and compliances due to its transparency. If we see this formal institutional change, adoption of the Blockchain is likely.

If the technology is widely adopted and implemented, the question is how the different stakeholders should act. Christensen (1997) suggests setting up a new organization to be responsible for the disruptive technology. This is similar to what Nasdaq has done through implementing their own Blockchain - Linq - for securities transaction, separated from their already existing infrastructure. Markides (2006) suggests forming strategic alliances, which is already happening in the industry where banks have formed the strategic alliance DLG to develop a Blockchain solution for mutual benefits. From the analysis of the Blockchain, one can see that there are two steps highly enabling disruption and one slightly disabling disruption. According to Rafii & Kampas (2002) this means that companies should monitor the competitive landscape or take action, such as starting internal development or exploring partnerships with emerging players. New organizations and partnerships has already started to happen in the financial system with Nasdaq partnering up with Chain, the emergence of DLG, and the cooperation between banks and Blockchain solution providers such as Ripple. This means that it is actually the customers that are jointly developing solutions, meaning that the disabling step, customer switching, is less relevant to decide potential disruption. If the customer switching is made easier, this would imply that incumbents should increase their presence through acquisitions, internal initiatives or partnerships according to Rafii & Kampas (2002).

However, even though the Blockchain technology seems to have disruptive potential, banks and stock exchanges will most likely not file for bankruptcy since they have the opportunity to replace their own systems and surf the wave of Blockchain development to utilize the technology and therefore disrupt themselves instead of being disrupted.

9.3 Usage-based insurance

According to Rafii & Kampas (2002) test, IoT within insurance got a result of -0.04, meaning that it is difficult to determine if the technology is disruptive. An insurance based on IoT would, according to the analysis, be slightly more attractive to customers but getting them to switch might be a problem due to the challenge of privacy and security, and low observability and trialability. UBI cannot be considered underperforming and is not targeting customers outside the main market. Although, it can provide features such as personalized premium, risk management that some customers in the main market might value. However, it is difficult to decide if it is cheaper, and it cannot be considered simpler and more convenient to use than existing insurance. Further, UBI is not helping customers to do what they are already trying to do but more easily and effectively. This speaks against UBI being a disruptive innovation (Christensen, 1997; Christensen et al., 2002). Moreover, Christensen (1997) presents another common scenario for disruption, which is that established products or services tend to overshoot the demanded performance. There are no signs that current insurance offerings would be perceived as overshooting, which would imply that disruption is not enabled. One could rather argue that an IoT based insurance would be overshooting and offer more performance than what is demanded by end consumers.

According to Christensen's (1997) classification, UBI is rather a sustainable innovation than a disruptive, since it just increases the performance of existing insurance services. It will provide another source of data for the insurer's risk model that could complement the existing algorithms and decision factors. One can argue that it would offer increased value in terms of risk management but it is difficult to prove the value of such a service for end consumers. The IoT can therefore be seen as a complement rather than a substitute.

According to the analysis, UBI does not offer significantly more value than traditional insurances. Although providing some additional functionality and is expected to offer a more convenient claim process, it is providing the same coverage and it is difficult to decide whether the price premium generally would be decreased or increased for end consumers. Instead, it seems like the biggest benefits with offering UBI are for the insurers to enjoy. As Sandquist et al. (2015) and Bruno et al. (2015) state, these would be allowed insights on customer behaviour, get additional customer touch points and increase the overall customer stickiness through new offerings etc. This might be due to a lack of involvement of the end customers, which Reifel et al. (2014) emphasize for development of relevant IoT services. There are several institutional barriers that need to be overcome in order to increase the customer attraction and make it easier for customers to switch into UBI. Firstly, there are the challenges with privacy and security, both from a technological and a regulative point of view. Secondly, there must be an increased trialability and observability with UBI services. And finally, consumers must be able to calculate their expected premium.

There need to be an institutional change in order to overcome such barriers. One can argue that there has been a slow-moving institutional change in norms regarding privacy and data sharing over the past years. The emergence of social media such as Facebook, blogs, podcasts and Instagram might have increased the willingness to share personal information. According to Bothun et al. (2012), younger people are generally more willing to share personal information, which indicates that a shift in generations can further increase the change of norms regarding sharing of personal information. However, a formal institutional change is also needed for the IoT within insurance to develop, but tradeoffs when implementing laws and regulations have to be kept in mind as described by The Expert Group on the Internet of Things (2016). According to Friedman & Canaan (2014), a way of motivating users to adopt UBI could be to offer price discounts. This argument is supported by Peters et al. (2005), who argue that triggers of institutional change are economical. Moreover, Nutall (2015) argues that it is possible to increase end consumers' willingness to adopt through showing real world cases. The institutional change is a prerequisite for UBI to succeed, and further change is necessary to get a widespread adoption of UBI.

Even though UBI does not seems to be a disruptive technology, it has potential to be widely adopted in the insurance industry. However, in order for it to happen, the stakeholders in the industry need to cooperate and develop a common standard for the solution. This is emphasized by Eckenrode (2015), Dahlberg et al. (2016) and Reifel et al. (2014) stating that partnerships with actors outside the traditional ecosystem are useful for a test-and-learn approach. The infrastructures and systems need

to be developed to handle the increased amount of data, and they must be compatible to analyze the IoT based data in combination with the traditional data submitted by the customer and third parties.

10. Conclusions

The emerging innovations that has been covered in this report will affect the three main functions in the Swedish financial system as well as its markets. P2P lending, Debt crowdfunding, Equity crowdfunding and the Blockchain Technology for issuance and transaction of securities are all new ways for allocating savings into financing, where P2P lending and Debt crowdfunding are present in the fixed-income market and Equity crowdfunding and Blockchain operate in the equity market. UBI is a new source to manage risk for insurance companies and P2P foreign exchange is a new way to effectively buy currencies outside the traditional foreign exchange market. Moreover, the Blockchain provides a new payment function outside the traditional banks and their systems. It is certain that these technologies will affect the financial system in some way, but it might not be appropriate to define innovations as either disruptive or not, but rather that these are disruptive with respect to a specific firm, system or process in the financial system.

P2P lending and Debt crowdfunding are not expected to become the first choice for borrowers and investors in the main market, and are thus not considered to be disruptive business model innovations. Instead, these are perceived to be complements to existing services in the fixed income market, allowing borrowers and investors an alternative access to funding and place for investments respectively. Equity crowdfunding is not expected to become the first choice of listing for companies in the main market, and therefore not the first choice for investors in the main market. Thus, it is not considered to be a disruptive business model innovation. Instead, it is perceived to be a complement for investors to invest at stock exchanges and MTFs. P2P currency exchange is perceived to be a "good enough" business model that is scalable, and it got high potential of attracting customers from the main market. Thus, it is considered to be a disruptive business model.

The Blockchain Technology is expected to be a disruptive innovation and is likely to become a new standard for how payments are made and securities are issued and transferred. However the banks and stock exchanges will probably disrupt themselves and therefore utilize the technology without getting replaced. Other systems and organizations that risk getting obsolete is CLS, Bankgirot, Euroclear Sweden and INET Nordic. Internet of Things within insurance need formal- and informal institutional change in order to be widely adopted. Although that change is expected to happen UBI is not considered to be a disruptive innovation, but rather a sustainable innovation complementing existing risk calculation models.

For future research, it would be interesting to further investigate the possibilities of combining the emerging technologies. P2P lending and Debt crowdfunding may be further developed by utilizing Smart contracts and the Blockchain Technology. If these lending platforms are built upon a blockchain, smart contracts could be used to automate the lending processes by automatically pay out the loans when enough funds are invested. According to Tuesta (2015), any loan can be represented as a smart contract in a Blockchain, but it would be interesting to investigate how this would affect the lending business. Furthermore, it would be interesting to further investigate how a Blockchain can be used in the insurance industry, since property can be registered in a Blockchain

and its ownership and the history of transaction can be verified by everyone, the Blockchain seems to be a suitable place to store insurance contracts.

Moreover, since P2P Marketplaces are rather new it would be interesting to investigate how these would withstand a recession. It would also be interesting to perform a longitudinal study of formal and informal institutions and how changes affect the disruptiveness of the innovation.

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