

Blockchain technology and its possibilities:
A qualitative study of the connections between
blockchain technology, the banking sector, and
(self-)regulation



Elisabeth Schellekens

Student number: 443537cs

Supervisor: dr. Jess Bier

Second reader: dr. Jennifer Holland

Word count without reference list: 9.998

Word count with reference list: 10.733

Word count appendix: 1635

Abstract

This study concerns itself with the question “what are the ways blockchain technology can shape (and vice versa) the implementation of regulation in the banking sector according to financial professionals?”. Through qualitative interviews and document analysis three topics related to the research question came forward. (1) Blockchain technology and disruption, (2) blockchain technology and (self-)regulation, and (3) Blockchain technology and challenges. The main message conceived by the respondents was that while the technology is currently being gradually implemented, it is too early to identify how regulating entities are going to react to a widespread implementation of blockchain technology into the financial sector. Some professionals argue that regulating accords are not necessarily going to be changed because of the technology. While others argue that the technology will be implemented into the banking sector with regards to compliance and (self-)regulation without a large change in the actual legislation. The overall argument is that financial professionals’ belief in the influence of blockchain technology can make it influential, however, not in predictable ways. The effects of power and the struggle for control involve a certain amount of unpredictability.

Key words: blockchain technology; banking; regulation; self-regulation

Acknowledgements

I would like to thank my supervisor Jess Bier for giving me a great experience and all of the useful feedback. I would also like to thank my parents for supporting me in my academic endeavors. I couldn’t have done it without you.

Overview

Part	Page
Chapter 1: Problem definition and relevance	4
1.1 Introduction	4
1.2 Academic and societal relevance	6
Chapter 2: Theoretical framework	8
2.1 What is the centralized structure and organization of the financial system and how does that differ from the distributed blockchain technology system?	8
2.1.1 The Medici system, centralized ledgers, and intermediates	8
2.2 How does the regulation and governance of international banking work and how does it connect to blockchain technology?	10
2.2.1 Regulation of financial institutions	10
2.2.2 Main regulations: The Basel Accords	11
2.2.3 Self-regulating mechanisms	11
Chapter 3: Methods and analysis	14
3.1 Interviews and participant-observation	14
3.2 Document analysis	15
Chapter 4: Analysis, findings, and results	16
4.1 Blockchain technology and disruption	16
4.2 Blockchain and (self-)regulation	22
4.3 Blockchain technology and challenges	24
Chapter 5: Conclusion and discussion	28
5.1 Conclusion	28
5.2 Discussion	29
5.2.1 Possibilities	30
5.2.2 Further research	31
Reference list	33
Appendix 1	36
Appendix 2	37
Appendix 3	38
Appendix 4	41

Chapter 1: Problem definition and relevance

1.1 Introduction

On the 31st of October, 2008 a man named Satoshi Nakamoto released a white paper on a crypto currency and an accompanying payment system called Bitcoin. This system was then in 2009 released via open source software and would revolutionize the way we think about ownership, payment, and money (Vigna & Casey, 2015; Huckle & White, 2016; Judd, 2016; Baxendale, 2016). Bitcoin's success lies in its underlying technology: blockchain. The way a blockchain works is quite easy:

"blockchain technology is a method by which parties previously unknown to one another can jointly generate and maintain practically any database on a fully *distributed* [emphasis added] basis. In reality, the system works so that each party is distributed a copy of the database (or part of it) who may then make changes to the database subject to collectively accepted rules. The changes made by the various parties are assembled and stored in the database at regular intervals as bundled packets called 'blocks'. When new blocks are added to the original database, they form a blockchain, or an up-to-date database containing all the changes made." (Mattila & Seppälä, 2015, p. 7)

Scholars have called the applications and effects of blockchain technology groundbreaking and disruptive (Wright & De Filippi, 2015; DutchChain, 2014; Vigna & Casey, 2015; Huckle & White, 2016). This disruption will be most prominent in the framework of the world economy, with its vast landscape of trade through financial institutions. The financial sector accounts for a very large portion of the world economy, due to the fact that these institutions are in charge of the centralized ledgers and communication between them. According to Benoît Legrand (Global head of FinTech¹ ING bank) banks are the core of our society and economy. Basically, doing business is not possible without the intermediate services of the banking sector (Vigna & Casey, 2015). Within this large financial sector, regulation plays a vast role. Some scholars make the point that the financial sector is under regulated while others make a case for overregulation (Carruthers, 2005). Regulation is a pressing topic. Especially after the global financial crisis of 2007-2008 the call for compliance is larger than ever. Blockchain has the possibility to open markets all over the world and can change the current position of financial institutions. Compliance in this context means what the Basel committee describes as:

¹ FinTech stands for "financial technology", and it is often used in the financial sector to explain that start-ups and new innovative technologies are connected to it.

"Compliance laws, rules and standards generally cover matters such as observing proper standards of market conduct, managing conflicts of interest, treating customers fairly, and ensuring the suitability of customer advice. ... A bank that knowingly participates in transactions intended to be used by customers to avoid regulatory or financial reporting requirements, evade tax liabilities or facilitate illegal conduct will be exposing itself to significant compliance risk." (Basel Committee on Banking Supervision, 2005, p. 7)

In the current banking system, records for financial trades are recorded in centralized ledgers that are not connected to each other or open to everyone. To use multiple ledgers at the same time, people or organizations pay intermediaries (trusted third parties) to make connections between several ledgers (Mattila, 2016). However, these are expensive and they take time to implement. A blockchain allows for computers to communicate online with each other and make one giant shared ledger. This massive ledger is not owned by anyone, nor is anybody or any institution in charge of it (World Government Summit, 2017). The computers plugged into the blockchain form nodes in a massive network and are linked to each other, and from a distributed and decentralized network (Barabasi, 2002; Abbate, 2000). This is fundamentally different from the current centralized ledger the financial institutions use.

As a consequence of this distributed network, all computers in the blockchain have the online ledger that is updated in real time. That means if transaction between parties are done through the blockchain, the nodes have to communicate with each other and reach a consensus (Mattila & Seppälä, 2015). In other words when a transaction happens, all the computers in the blockchain 'talk' to each other and compare their real life ledgers. If there is an inconsistency anywhere, no consensus is reached and the transaction is rejected.² This widespread comparison can happen because the ledger is open to anyone in the blockchain, and all transactions are viewable. Therefore, the blockchain is called a shared single source of trust and truth (DutchChain, 2016). It is a huge advantage to have a trading system that is completely reliable and exudes trust because it reinforces a "more democratized space of social and economic activity" (Mattila, 2016, p. 21).

Another advantage of the blockchain is its currency. Currently bitcoin is the payment form, but this does not have any stand-alone value; bitcoins are translated or programmed into currencies. These currencies can be linked to any "social construct of value": Euros, Dollars, deeds to houses, stock, votes, energy, contracts, etc. (Huckle & White, 2016, p. 15; Mattila &

² There needs to be a consensus on at least 51% of the computers linked to the blockchain.

Seppälä, 2015; Carruthers, 2005). In the blockchain, bitcoins therefore represent many different forms of ownership or property. Because of the programmable nature of bitcoins and the blockchain, it gives the financial sector the possibility to completely reform and innovate itself. Blockchain technology can allow banks to implement automated compliance before transactions or actions in general take place (NRC Live FinTech Conference, 2017). This differs radically from their current system where the compliance and audits take place afterwards. More efficiency, more transparency, and less bureaucracy are just a few of the effects of blockchain technology.

Blockchain has the ability to cause a paradigm shift in the world economy (DutchChain, 2014; Mattila, 2016; Huckle & White, 2016). This master thesis focuses on how blockchain technology impacts the financial industry. It studies financial professionals and their impressions, beliefs, and conceptions of how blockchain technology may impact finance. Within this topic, I focus on regulation and how blockchain technology can disrupt, change, or improve attempts to control and manage the banking industry. The central research question is “what are the ways blockchain technology can shape (and vice versa) the implementation of regulation in the banking sector according to financial professionals?”

The goals of this thesis are to combine the analysis of economic interests with an analysis of social relations, to develop or connect a theory or expectation from all the data gathered that explains what effects of blockchain technology can have on the regulation of financial institutions (and vice versa). The theories explained in the theoretical framework will be used to define the direction the thesis goes in and the material it will explore. My interviews and primary document analysis will then provide a framework for a detailed and contextualized answer to my research question.

1.2 Academic and societal value

The academic relevance of this thesis is to add to existing sociological work on financial regulation, and specifically the regulation of new currency technologies and methods. The focus will lie on the main framework for regulation: the Basel accords. Currently, there have not been thorough overviews on this specific topic, and certainly not enough critical academic work.

There is an abundance of popular literature (such as newspaper articles, magazine articles, etc.), but not enough scholarly work. Because of this there has been a tendency in literature to 'hype' the technology, and this thesis aims to give a situated overview of what the effects of blockchain technology are on regulation in the financial world (for example Basel III). Furthermore, the thesis will also have societal relevance since it aims to inform and describe a relevant societal development. Because the banking sector is such an ingrained part of our global economy and everyday life, it is important to encourage public understanding and help people to understand how new technologies (such as blockchain) can influence financial regulation. Blockchain technology and especially Bitcoin have been in the center of much news coverage, but so far its actual impacts are unclear. Therefore this thesis will research the effects this technology may have on society, as viewed by those working in finance.

Chapter 2: Theoretical framework

Scholars in the sociology of finance have studied many topics: banking regulation (e.g. Christophers, 2013, 2016; Singer, 2007; Davies & Green, 2010) but not with respect to blockchain technology, and financial technology (e.g. Knorr Cetina, 2005; Clark & Thrift, 2005; Power, 2005) but not with a focus on regulation. This literature review gives an overview on what scholars have argued and in which disciplines and specialties. It outlines what the scholarly literature says about my topic, and then identifies a gap that my research will fill (blockchain technology's effect on banking regulation). Next to this this chapter provides important background information.

2.1 What is the centralized structure and organization of the financial system and how does that differ from the distributed blockchain technology system?

2.1.1 The Medici system, centralized ledgers, and intermediates

Banking works by depositing and loaning money to and from people. All of this works by a centralized record keeping of those deposits and loans of money (Hull, 2012). Researchers in the history of finance have pinpointed the development of this system to the late 14th century. During this time the Italian Medici family developed a new banking system that would revolutionize society. The Italian bank played a central part in the development of our current banking of exchanges of currency and assets. Vigna and Casey (2015, p. 4) have looked at the Medici's system's influence on finance: "they figured out how to intermediate between savers and borrowers, bringing in the excess capita; of the former and parceling it out to those among the latter who needed it – all for a fee". De Rover proved that the Medici family amended the ledger keeping system by establishing a double entry structure where deposits and withdrawals (debits and credits) were used (Helleiner, 1950).

Fryde (1950) argued that this meant a breakthrough in finance; by creating this system, their bank became much less vulnerable to defecting on risky loans and going bankrupt. This in turn created a centralized system of trust (Vigna & Casey, 2015): it enabled the bank to make

connections between strangers and act as an intermediary between two parties doing business together while lowering risk for both parties. As a result society experienced an enormous shift in the way business was conducted. Because people were not able to do so without the bank's help anymore, since the bank now provided this trust. From this initial banking system all intermediate financial services come forth such as: financial lawyers, accountants, etc.

Fast-forward to today, the power of centralized trust created by the Medici family has not wavered; modern day banks are still powerful institutions. Scholars in the sociology of finance argue (implicit and explicit) that the realization of this transformation brought on by the Medici family changes the way this complex, global, non-transparent, messy industry should be studied. With the help of the Medici, world economies have become connected and individuals and organizations cannot do business without the help of these centralized financial institutions. They have become "fee-charging gatekeepers" who manage the "financial traffic that made economies tick" (Vigna & Casey, 2015, pp. 4-5). This banking system is exclusionary, because people need a bank to function as a facilitator. Below is a visualization of how people and businesses trade with each other. It cannot be done without banks.

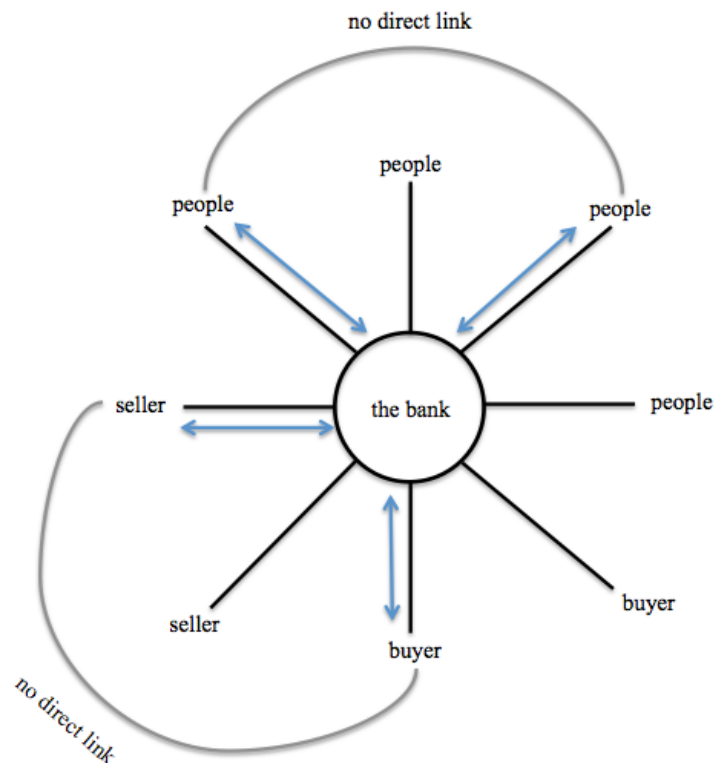


Figure 1: visualization of the bank as the intermediate (figure by author).

However, as previously demonstrated, blockchain technology follows a different path, a distributed one. Which can have the possibility to undercut the functioning of several financial institutions, through its openness, auditability, and decentralized manner of functioning (Mattila & Seppälä, 2015; Huckle & White, 2016; Reijers, O'Brolcháin, & Haynes, 2016).

2.2 How does the regulation and governance of international banking work and how does it connect to blockchain technology?

2.2.1 Regulation of financial institutions

Banks have become powerful financial institutions. However, with this central position in the economy and society come responsibilities. When people entrust organizations with the task of preserving their money, regulation by governments and supranational institutions is tied with it. Currently the role banks have in the money supply is vast, combined with state regulation they are the gate-keepers of the world economy (Carruthers, 2005; Vigna & Casey, 2015; Knorr Cetina & Preda, 2005). However, it has to be noted that there has been a vast rise of non-banking financial institutions (such as shadow banking and very diverse FinTech). Nonetheless, banks remain dominant in the financial sector.

Researchers in regulatory finance argue that the purpose of regulation in the financial world is to aim for more transparency, auditability, trust, and stability (Clark & Thrift, 2005; Mattila, 2016; Power, 2005). When talking about the financial sector and the world economy, sociologist and economists are often critical about the role of state regulation on capital markets (Brewster & Mizruchi, 2005). Scholars have made the case that since the global financial crisis of 2007, there has been an outcry of (stronger) re-regulation of finance and banking (Christophers, 2016; Hull, 2012). Currently, the regulation of this branch has as a reference and starting point the centralized way of ledger keeping in financial institutions.

2.2.2 Main regulations: The Basel Accords

In 1988 bankers from all over the world came together in Basel, Switzerland to form the Basel Committee on Banking Supervision (BCBS). In this meeting, bankers set up standards for international banking regulation (Hull, 2012). The accords that were agreed upon in this conference later became known as Basel I, and were mainly focused on “international risk-based standards for capital adequacy” (p. 259). The accords were enforced by the G-10 countries from 1992 onwards. Then in 1999 the Basel II accords were founded because Basel I received critique from the banking sector and governments, who claimed that its measures were too subjective and uninformed (Hull, 2012). The second Basel accords exists out of three pillars. The second and third pillars are in place to reinforce the first pillar, because as Singer (2007) argues it has human shortcomings, and the regulation that comes forth from the first pillar could be 'easily' manipulated. Basel II places a lot of power in the hands of the banks by enables several self-regulatory mechanisms.

A new regulatory framework was put into works after the global financial crisis of 2007-2008. Some critics blamed Basel II and its strong move towards self-regulation for the crisis, and from this came an outcry for more, stronger, and more strict (self-)regulation. This then culminated into the Basel III accords that were published in 2010. The initial implementation of Basel III was supposed to happen from 2013-2015. However, due to criticism and further changes in the accords this has been pushed back to 2018-2019 (Hull, 2012). Stronger liquidity requirements and tightening of credit risk are emphasized in Basel III. Banks have to adhere to all of these strong regulations, and mostly this is done through self-regulation. According to scholars like Huckle and White (2016) and Mattila (2016) self-regulation is particularly relevant in relation to blockchain technology, because the technology enables a more automated and bureaucratized form of self-regulation.

2.2.3 Self-regulating mechanisms

When blockchain technology is implemented in the world economy as a form of conducting transactions, the method of (self-)regulation changes because, as discussed previously, the system then reverts from a centralized one to a distributed one (Mattila & Seppälä, 2015; Vigna

& Casey, 2015; Reijers et al., 2016; Huckle & White, 2016). When blockchain technology is used in a (self-)regulatory fashion it falls in the category of RegTech. RegTech stands for regulatory technology and it refers to technologies that can be used to implement compliance and/or ease regulatory standards. This has an immediate effect on transparency, auditability, and trust due to the nature of the technology, and therefore the way the issue of regulation is tackled. There is the possibility that regulation of the financial sector can become more effective than it is now. The compliance of banks in particular can become more efficient because, with blockchain technology, compliance can happen before transactions, instead of afterwards like is now the norm. The way compliance is regulated within the financial sector now, is through auditing afterwards to see if rules, laws, and ethics were followed. With the built-in rules of the blockchain this changes fundamentally. Before any action can be executed there needs to be consensus or permission along the whole of the blockchain. In theory at least, this makes 'illegal' actions practically impossible.

Next to active (direct) government-enforced regulation such as Basel III, the financial sector also exercises self-regulation. This is still government-enforced regulation but happens in an indirect manner. Clark and Thrift (2005) argue that in the financial sector there has been a return to increased bureaucracy as a coping mechanism or a self-regulatory instrument. This process has given the industry more stability, integrity, and performance. As well as power, in the sense that the power for regulation lays within the banks. Currently the FX market³ faces the challenge of managing "dispersed knowledge" while controlling the "total institutional risk exposure." Clark and Thrift (2005, p. 230) argue that through this increased bureaucracy in the sector this risk is brought back to a minimum. Another cause of the return to more bureaucracy in the banking branch is also the increase of regulation, due to recurrent financial scandals and the big 2007-2008 financial crisis (Hull, 2012; Clark & Thrift, 2005; Brewster Stearns & Mizruchi, 2005). Financial scandals have made the reputation of banking institutions more important and therefore self-governance has become more important. There is a clear trend that the industry has done this through implementing more bureaucracy. More bureaucracy is compatible with the blockchain technology framework. This is because the technology can be used for automated bureaucracy, through the permanent ledger that is available for all those

³ The FX market is the foreign exchange market where currencies are traded in a global and decentralized manner (the buying of currencies, the selling of them, and exchange is done on this market).

connected to the blockchain. Moreover, these can be more effectively reinforced through the technology. More bureaucracy often means that information should be clearer and more regulated through record keeping (Scott & Davis, 2007). Since the core of blockchain technology lies within this distributed ledger that is accessible to everyone (Mattila & Seppälä, 2015), information becomes much more subject to oversight. Also because the information is the same everywhere, this works in favor of bureaucracy and cuts the time spent on record keeping.

A second self-regulating mechanism for protecting reputation, integrity, and stability is ERM, or enterprise risk management. This risk management framework helps institutions to assess risks and opportunities and strategies to optimize these, while creating and protecting a company's reputation, integrity, value, etc. Power (2005, pp. 262-263) makes an argument that ERM is embedded in the "moral economy of financial organizations" by incorporating reputation management, an ERM strategy, as the "organizational privatization of public policy." Power argues that the current legal system in place for financial institutions will reinforce the legitimacy of the ERM model. This will happen through the auditability and responsibility elements that the model has incorporated as a business strategy:

"The ERM world model translates potential public policy issues into matters of organizational process (rather than scientific expertise) at the enterprise level. Thus, the social and environmental externalities of financial and other organizations are reworked and internalized as matters of reputational risk management." (Power, 2005, p. 263)

This signals that with the implementation of ERM into the financial sector, institutions can account for regulation as a business strategy. ERM is about reclaiming control to the financial sector, in the sense that with it control over strategy and regulation are connected and can be influenced by the bank. The appeal of this is that ERM allows for a democratic form of financial risk analysis at the organizational level (Power, 2005). ERM is thus also compatible with blockchain technology: the blockchain can be programmed to focus on moral actions as to enforce ERM. ERM names legitimacy and auditability important self-regulating enforcers. Since blockchain technology makes information much more auditable and legitimate because of its open nature (Huckle & White, 2016; Reijers et al., 2016), this technology can enforce be beneficial with ERM.

Chapter 3: methods and analysis

3.1 Interviews and participant-observation

This thesis is a work of qualitative sociology, and interviews are one important source of data for the study. Qualitative research and interviews were chosen because one can learn how people are working with the technology in their everyday work, their future expectations, and their views on the technology. Especially since little has been published about the topic, this way of gathering information has proven valuable. For the ethnographic research I have interviewed 11 people (semi-structured) and gathered opinions from 4 persons. From the interviews 7 were complete questionnaires (respondents 1, 6, 7, 8, 9, 10, 11), and 4 were shorter ones where only a limited amount of time or questions were available (respondents 2, 3, 4, 5). The questions were in reference to what has been found in the document analysis and the theoretical framework.

The people that have been interviewed have been selected through their position in the financial sector, banks, FinTech, RegTech, and regulating entities. They form a strategic sample in the sense that they are knowledgeable players in a range of organizations that are related to the financial sector and regulating entities. For this it was important that different kinds of professions from every relevant area of organizations were represented (banks and regulators). Examples of these are: financial lawyers at large French banks (legal perspective), a partner at PwC compliance (financial services perspective), innovation experts from major international banks (technology perspectives), and young apprentices in large banks (young graduates perspectives). Because of the nature of European countries regulations are financially well-connected and fine-tuned to each other, therefore the researched field for this thesis is Europe. Next to the interviews I conducted participant observation during a major and influential FinTech conference in the Netherlands organized by national newspaper NRC. In this observation a fly-on-the-wall approach was used to gain a sense of the interaction of professionals within the financial sector. During the conference there were also many opportunities to talk to and ask questions to people in the industry.

The banking sector is a very tight-knit and male dominated industry, therefore it proved hard to gain access to it as a non-professional and female student. Over the course of the thesis trajectory I have reached out to around 30 knowledgeable players in the field. Often this would not yield a response, in some cases people were very accommodating (interviewee 1, 6, 7, 8, 9,

10, 11). In most responses I could only get a limited amount of time, access, or questions (interviewee 2, 4, 5), and others just give me their general opinions on blockchain technology and regulation (12, 13, 14, 15). In light of these limitations I took the time that was given and maximized that, which in the end yielded very useful results. Especially in the short inquiries it forced me to get straight to the point, and the answers given were of great value. In the case of respondent 3 the interviewee did not have a lot of time to answer questions but handed over a personal essay with handwritten notes on it regarding the subject (respondent 3), in which most of the interview questions were answered and which proved very valuable for the research

3.2 Document analysis

I performed a document analysis to complement and extend the interviews. This provided an indication of trends, key-words, developments, and investments. The document analysis is especially interesting when compared to the results of the interviews. The document analysis consists of an extensive review of primary sources. There are primarily white papers or overviews/records of blockchain technology summits as well as powerpoint presentations given by key players in the field. Examples are a program manual of a FinTech conference, an IBM executive banking report, CapGemini consultee reports, and a World Government Summits report. As well as presentations by the Global Head of FinTech at ING, an Innovation Manager at Rabobank, and a former UBS CIO. In the document analysis these sources have been analyzed. The three most relevant primary documents were put into a topic matrix where it became clear what has been said on certain subjects and if the sources agree or disagree on subtopics. The following matrix was used:

Approach / reason of the document	Financial institutions: adopters of technology	Investment areas in the financial industry	Current situation in finance
and			
Expectations of the technology (regulation)	Benefits technology (for banks and regulators)	Recommendations for regulatory measures	Threats financial industry

As a last section of the document analysis, word-clouds were generated on the primary sources, to give an indication of most-used words, importance, and links between topics.

Chapter 4: Analysis, findings, and results

Based on the literature study, document analysis, and interviews three main topics have come forward as answers to the research question (“what are the ways blockchain technology can shape (and vice versa) the implementation of regulation in the banking sector according to financial professionals?”). (1) Blockchain technology and disruption. (2) Blockchain and (self-)regulation. And (3) blockchain technology and challenges. The sub headers for these three topics all consist of statements. These statements represent opinions of the respondents, which often come up across multiple interviews. Next to the three topic divisions there are two themes of importance that kept coming back in the research: control and power. Throughout this chapter those two will be referenced and analyzed.

4.1 Blockchain technology and disruption

4.1.1 Respondents: our immediate future will be more automated (Big Data, cloud computing, Robotics, AI, IoT, etc.)

An interesting finding while researching blockchain technology is that the technology is not a stand-alone one. It is one in a series of technological developments linked to cloud computing and big data, which is part of a larger more automated future. Together with other technologies they form an ecosystem of technology convergence (Bussmann, 2017). The diagram below (figure 2) represents one view of such an ecosystem where blockchain technology ("distributed ledger technology") plays a vast role. The whole of the spheres in the illustration embodies this automated future and ecosystem discussed above, the yellow sphere represents blockchain technology. This ecosystem will be used in the banking sector, interviewee 9 (blockchain project manager at large European bank) echo's this future projection: “I would expect that banks will operate in the next 10+ years with considerably less human resources”.

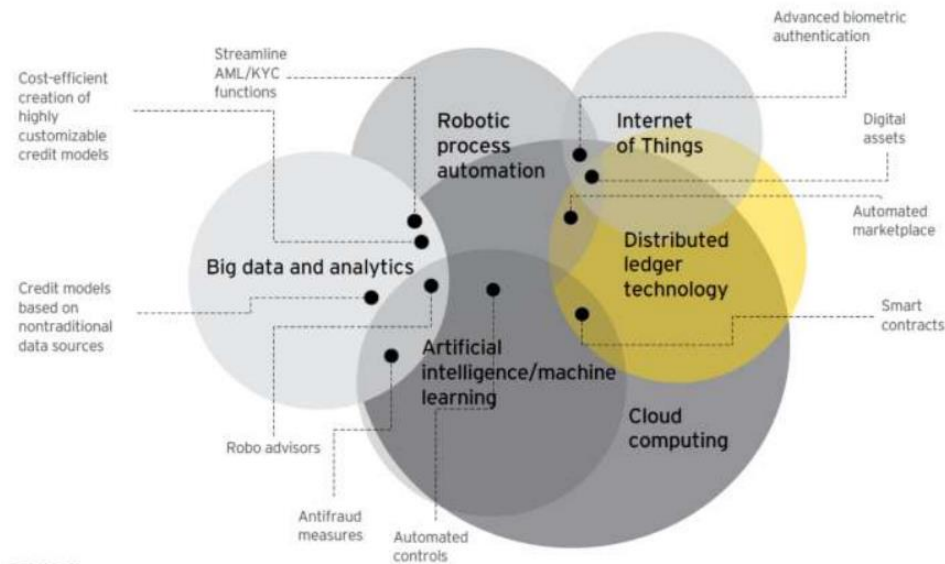


Figure 2: blockchain technology's role in cloud computing and big data ecosystems (Bussmann, 2017, p. 10)

Figure 2 illustrates a view expressed by many of my respondents, that these technologies are both interlinked and will be a part of our automated future. However, it is important to be critical about this material. Because this is just one representation about this automated future, and it is fully focused and developed by people in the financial sector (advisory and consultant). This in short means that there is an agenda behind it, which then can prevent it from being truly honest. This therefore falls under the theme of power.

When dealing with the implementation of a new technology like blockchain, it is important to consider who will be in charge of it, and who will hold the power. As mentioned before no one holds power over the blockchain itself, but the applications made by financial institutions are led and thus controlled by banks. Another important question that then comes to mind is why do banks want to support blockchain technology? To answer that question another 'simple' question has to be answered first: what is the core driver of banks? The 'simple' answer to this is to make profit. Regulation costs banks a vast amount of their profits (respondent 3, partner at large regulatory services firm), so they are constantly looking for ways to streamline and make it more cost efficient. Interviewee 9 even stated: “the cost of compliance for financial institutions has exceeded the cost of non-compliance”. Blockchain offers the possibility of cost efficiency and streamlining in the whole scheme of an automated future and therefore makes making profit easier; mainly because of the cost benefits and automated compliance (IBM, 2017; CapGemini, 2017).

4.1.2 Respondents: in this automated future there will be more opportunity and need for the implementation of blockchain technology into the world economy and thus financial institutions

Over the past two decades these technological developments have received a great amount of research, development, and usage in the world economy (Gartner, 2016). Expectations are that these technologies will be a large part of people's everyday lives.⁴ As noted earlier, in the financial sector organizations and companies that deal with this ecosystem are referred to as FinTech. Within the ecosystem, blockchain technology (yellow sphere in figure 2 above) will start to play a large role. This has also been validated and endorsed by my document analysis and interviews. According to Benoît Legrand, speaker at NRC Live FinTech conference, 35-40% of the revenue of banks is currently at risk to be lost to FinTech companies; the companies that deal with the ecosystem illustrated above (Legrand, 2017, p. 2). This means it is widely believed in finance that there is presently an opening and opportunity for banks to invest in these technologies in order to regain ground.

In the previous section a discussion of power was started. In this new more automated future a power vacuum can exist. Because next to performing compliance, blockchain technology also gives banks other opportunities: it provides new business models and new opportunities for market share through enlarging the size of the market itself (respondents 1, innovation expert at Dutch bank; 2 former CIO Swiss bank; 8, economy apprentice at a large French bank & 9). This all sounds very good and promising. However, large banks are forced to participate, whether they want it or not. Because as mentioned often in the interviews: if you're not at the front of the development (as a trailblazer) you end up losing out in the long run and the viability of your organization will be threatened. Next to that there is a lot of messiness in the sector and the implementation of blockchain technology as well (Christophers, 2013). This will form an obstacle and challenge for the implementation of blockchain technology.

With all of this it has to be taken into account that in the end the regulating entities will hold the largest power. Because without their approval, the viability of banks is endangered

⁴ This is of course primarily true in the case of Western countries where such technologies form a large part of society. [Technology does have significant social influence in non-Western countries, but at times it's different technologies, or they're used in different ways.]

anyways. This bring forward the issue of how regulation is studied, and ultimately enforced. Legislation for compliance in the banking sector is currently a very rigid thing that does not take into account fast-paced changes of for instance new technology. As one of the interviewees mentioned "I yet presume that nobody will really care about the blockchain in the regulatory sector compared to the huuuuuuuge implication of Basel III / Banking Union / TLAC / MREL and so on" (interviewee 7, policy employee large French bank). This argument was also resonated by respondent 8: "I think that the blockchain technology moves too fast for regulators". Since technologies are usually fluid and fast evolving entities, this makes a stark contrast with the complicated legislative process. Especially banking across boundaries (Christophers, 2013)

4.1.3 Respondents: because of this automated future and the role of blockchain, the technology is going to be disruptive

My respondents in regulation and the banking sector (interviews 1, 2, 3, and 5, innovation manager at Dutch bank) repeatedly mentioned that blockchain technology is going to be disruptive for the financial sector. Respondent 9 stated: " it has been a rapidly accelerating process. ... currently, hundreds of stakeholders are engaged in blockchain efforts". They came to this conclusion after their organizations invested vast amounts of money into the development of the technology, became active in getting the technology to market, and as they perceived more and more media/professional attention to the technology. As interviewee 12 (managing director of a professional services firm) put it: "It is great that there are so many developments in FinTech [such as blockchain], as a financial institution you have to be on top of new developments. If not you'll lose out later in the game with market share" This response is interesting because the respondent does not name blockchain technology as a good or bad development, but does note that people like it and expect it to influence markets. In that sense the path blockchain technology follows can be seen as a self-fulfilling prophecy. Because so many people are enthusiastic about it and are investing in it, there is little room for the question if the technology is actually working and a good fit for the financial sector. Looking at the primary sources this claim is also supported (IBM, 2017, World Government Summit, 2017). For example, an

executive report by IBM and the Economist concluded that blockchain technology is gaining ground in the banking sector:

"Across the industry, banks are investing in international payments, other cash management, corporate lending, consumer lending, mortgages and deposit taking [with the help of blockchain technology]. These findings reveal that blockchain adoption is accelerating faster than originally anticipated, with organizations identifying key areas and benefits in which to explore solutions."
(IBM, 2017, p. 1)

However, as a report by CapGemini (2017, p. 9) puts it, it is very important to "calculate a methodical approach" when it comes to the application and adoption of blockchain technology into an organization or a company. During my research, respondents reported that there are three main areas where blockchain technology will yield the most profit: reference data, retail payments, and consumer lending (IBM, 2017). An example of consumer lending was given by interviewee 1: their bank recently launched a mortgage platform where all parties (notaries, accountants, the client, the bank, land register, etc.) are connected to the blockchain which makes the process faster, more efficient, and more trustworthy. Next to the three areas of profit opportunities, there were constantly named benefits: cost benefits, increased speed, and decentralized and auditable transactions (CapGemini, 2017; IBM, 2017; World Government Summit, 2017). These three benefits were mostly confirmed by respondents 1, 3, and 5 with an extra notice from interviewee 2, who also named a simplified ecosystem through the common ledger as a main benefit.

The positive response to blockchain came from most of the respondents, as the financial organizations these people worked for had already made vast investments into blockchain technology and had ready-to-market business models. However, there were some (whose organizations had not started the investments and/or began pilots) that were hesitant or negative. Interviewees 13 (account manager Dutch bank) and 15 (asset manager Dutch bank) for instance noted that they had seen the "hype" around blockchain technology and the vast media attention it has gotten, but were very hesitant in the "actual application and adoption" in the financial sector. Interviewee 13 stated "I just don't get how it can or will work in the financial sector" and interviewee 15 noted "I just do not foresee blockchain technology working [in the asset management field] for the next 50 years". It should be noted that overall the positive responses

came from people in the financial sector that were at least senior executives, and the negative or neutral responses from non-senior executives. This is an interesting find, because why could this be the case? It could be that the idea behind blockchain technology sounds good and is good on an executive level. However, the people who actually have to implement it are more hesitant. This can have three reasons: perhaps the technology does not work as well as intended. Or it is harder to deal with in reality. Or it might be that it requires a large change in organization structure and thus effort to change from the status-quo. Respondent 8 also conveyed that notion, this person is currently responsible for “constructing macroeconomic stress test scenarios that are used for internal and regulatory purposes”. And as he stated he did not really expect blockchain technology to take flight within his bank, because of the largeness of it and the complex organizational structures.

CapGemini's (2017, p. 31) world FinTech report indeed conveys these struggles a lot of people in finance have: "despite all the activity, the industry as a whole is still struggling to understand blockchain. Most financial services executives (60%) display only a basic understanding of blockchain technology and less than 10% feel they have a very good understanding".. This was again proved during a conference where I approached an innovation manager of a large European bank to ask about connections between blockchain technology and regulation. His immediate answer was that he did not know enough about the topic to answer my first question⁵ after giving a 30-minute presentation about FinTech and blockchain technology in his bank.

Given these responses, my first sub-conclusion is as follows: according to senior executives in the financial sector, our immediate future will be more automated and there will be more opportunity and need for implementation of blockchain technology into the world economy and thus financial institutions. While these senior executives named blockchain technology a disruptive one for these reasons, not everybody in the field agreed with this statement, especially the ones that did not comprehend blockchain technology.

⁵ Question: "do you think blockchain technology will have an effect on the current European regulation and regulation still to come, like Basel III?"

4.2 Blockchain and (self-)regulation

As mentioned earlier in the theoretical framework, regulation is a much debated topic in the banking sector. Especially compliance is of great importance in the financial sector. According to interviewee 3 there has been a "flood wave" on new regulation with almost "30.000 regulatory documents published by the G20 since the economic crisis". They mentioned that regulatory measures are indeed needed, however they do prevent banks from operating "effectively and efficiently". With this statement interviewee 3 stated that RegTech such as blockchain technology is becoming more important and is needed to "curb increasing costs of compliance." They see the technology as an "answer to the legacy IT systems that made data collection, monitoring, and reporting compliance extremely complicated and expensive". Again this is supported by primary documents (CapGemini, 2017; IBM, 2017, World Government Summit, 2017).

When the question was asked if my interviewees thought that blockchain technology could influence or improve (self-)regulation in the banking sector, answers ranged from "surely!" (interviewee 10, legal intern in IT department of French bank), to "I think the first beneficial effect will be on regulation" (respondent 11, legal intern in innovation department at French bank), to "that seems obvious" (respondent 6, financial lawyer at French bank). Interviewee 1 explained the "beauty" behind using blockchain technology as a compliance control in the banking sector: "with the using of blockchain technology compliance of regulatory measures happens before every (trans)action instead of afterwards, which makes self-regulation much easier. Regulating entities will then just receive automated audits through their own IPI channel of the blockchain to see the whole process".

However, how will regulating entities react to this new form of self-regulation by using blockchain technology? Interviewee 4 (program manager innovation and FinTech at Dutch regulatory entity) was asked: do you think blockchain technology will have an effect on regulation (for instance Basel III that will become effective in 2018-2019) or vice versa? His answer was clear:

"No, I think blockchain technology will be used the other way around. Especially in the organizational structure of banks or the trade relationships between organizations and companies. This is especially the case because of the irreversibility, indisputability, and trust of blockchain

technology, this will result in the lowering of costs of these entities. However, this whole principle can be executed within the current principles of regulation. The bottleneck of regulation lies more around the discussion if an authorizing entity or execution of it has to be changed to accommodate for blockchain technology. So not on the higher level of regulation accords like Basel III."

Respondent 4 explained thus that even though blockchain technology has the possibility to be disruptive to regulation, it could be that regulation will disrupt blockchain technology. This bottleneck of regulation is the problem of the current state of blockchain technology. That is why currently there are regulatory sandboxes⁶ where organizations can try out usage of blockchain technology, and from this regulatory guidance and certainty comes forth (Bussmann, 2017, respondent 3).

And here is where the second theme comes forward: control. With any new technology the question of control surfaces. As demonstrated in the theoretical framework no one or no entity can be in charge of a blockchain itself. However, the users (in this thesis banks) can be in charge of applications of the technology by developing usage such as GradeFix (ABN AMRO) or Collat'Shaker (BNP Paribas). The technology itself cannot be corrupted, but the people who write its code can be. Or they can be unethical in their programming. Currently the technology is implemented by banks through pilots, such as mentioned above. Since we are still in the 'early adoption' stage according to Bussmann (2017) and several respondents (3, 8, 9, 11) there are some regulatory sandboxes but organized compliance is not here yet. Another problematic issue can be the way regulation and banking are done across boundaries. Especially with blockchain, that can work fast and borderless, the control over what the blockchain does becomes fuzzy. Regulation in one country can for instance be different in another one, while the blockchain does operate in both countries in the same manner. Another implication for banks that is important was described by interviewee 6: "banks will no longer be considered as the only repositories of their clients' data [e.g. new business models]. This will have a significant impact on the applicable rules on the protection of personal and banking data".

Therefore, sub-conclusion two is as follows: my respondents believe that due to the nature of blockchain technology, compliance and (self-)regulation can become easier in the

⁶ "Regulatory sandboxes usually implement a set of rules that allow trailblazers to test their products and business models in a live environment with minimal legal requirements" (Cummings, 2017, n.p.).

banking sector. However, it might be an illusion that it will fundamentally change higher-level regulatory entities like Basel III. This then calls into question the disruptive power of the technology on a higher legislative level, but it can still be disruptive for the way the financial industry conducts their compliance at the moment and in the future (especially cost benefits and new business models).

4.3 Blockchain technology and challenges

As mentioned in section 4.2, blockchain technology has the potential to disrupt the financial sector. This development goes hand in hand with RegTech (of which blockchain technology is a part), which can theoretically make it easier and faster to deal with legislation (Korz, 2017; IBM, 2017). However, with each new technology there is the problem of implementation and usage. It became clear from my analysis of primary documents (IBM, 2017; World Government Summit, 2017), participant observation (NRC Live FinTech, 2017), and interviews (2 & 5) that in the so-called hype cycle of Gartner, blockchain technology is on its way to the plateau of productivity but has not reached it. "Gartner Hype Cycles provide a graphic representation of the maturity and adoption of technologies and applications" (Gartner, 2017, n.p.). The plateau of productivity of Gartner's hype cycle is the stage that every technology aims to reach. In this stage the "mainstream adoption" by the market takes off, and the technology will be applicable, relevant, and profitable on a large scale (Gartner, 2017, n.p.). The illustration below depicts Gartner's hype cycle and the different stages new technologies can walk through.⁷

⁷ The key terms in the figure are described as follows: "**Innovation Trigger:** A potential technology breakthrough kicks things off. Early proof-of-concept stories and media interest trigger significant publicity. **Peak of Inflated Expectations:** Early publicity produces a number of success stories. Some companies take action; many do not. **Trough of Disillusionment:** Interest wanes as experiments and implementations fail to deliver. Investments continue only if the surviving providers improve their products to the satisfaction of early adopters. **Slope of Enlightenment:** More instances of how the technology can benefit the enterprise start to crystallize and become more widely understood. Second- and third-generation products appear from technology providers. More enterprises fund pilots; conservative companies remain cautious. **Plateau of Productivity:** Mainstream adoption starts to take off. Criteria for assessing provider viability are more clearly defined. The technology's broad market applicability and relevance are clearly paying off" (Gartner, 2017, n.p.)

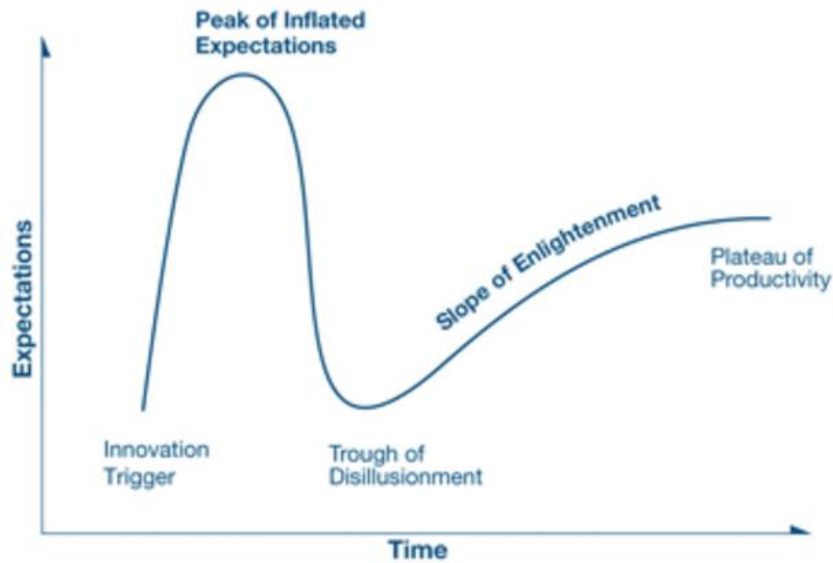


Figure 3: Gartner's hype cycle (Gartner, 2017, figure 1)

During the participant observation at the NRC Live FinTech (2017) conference Maarten Korz, Rabobank Innovation Manager, asked the audience where to put blockchain technology on the scale. The audience placed it over the peak and just before the disillusionment stage. This may suggest that the audience too may be suspicious or concerned that the hype on blockchain technology is greater than the reality. However, they can also be optimistic about when it will reach the plateau of productivity. Comparing this to an official Gartner publication on blockchain technology in August of 2016, as shown in the figure below, it is possible to see that the technology has furthered its journey towards the plateau of productivity.

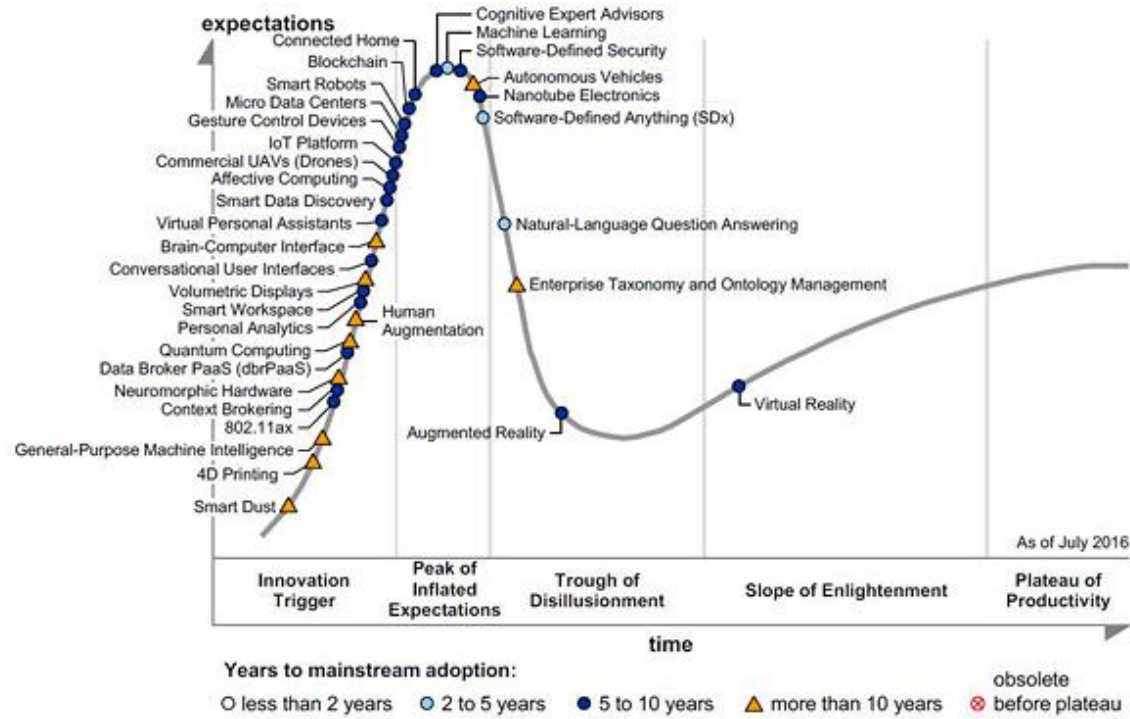


Figure 4: Hype cycle for emerging technologies 2016 (Gartner, 2016, figure 1)

In this figure it is also indicated that the expectation of the time period until blockchain technology is adapted into mainstream usage is 5 to 10 years. (This was the prediction as of mid-2016.)

Respondent 2, indicated a time line. He created his own time frame that started in 2015 with a stage of exploration and development where the technology was mainly adopted by banks. This was also supported by IBM's (2017) executive report, naming banks with more than 100,000 employees as "trailblazers". The second stage is early adoption from 2016-2017, where the first regulatory measures were developed such as "regulatory sandboxes, first rule-making, and FCA & MAS leading". The third stage is expected to be from 2018-2024 where growth of the usage is central. Interviewee 2 (CEO of FinTech advisory company) expects there to be "regulatory guidance and certainty" in the growth stage. From 2025 the technology will go into its maturity stage and will have become "integral to the capital markets ecosystem".

Given the analysis of Gartner's hype cycle and blockchain, the sub-conclusion is as follows: according to the majority of my interview respondents the biggest challenge for the

implementation of blockchain technology into the financial sector will be its inability to reach the plateau of productivity on the Garner scale. This is connected to adoption of the technology into the mainstream and its usage by financial institutions.

Chapter 5: Conclusion and discussion

5.1 Conclusion

Throughout this study it became clear that the sociology of finance literature is only beginning to analyze the possibilities of blockchain technology. This study shows that the approach to the study of finance, including ethnographic research and document analysis, can provide a contextualized and nuanced view of how financial professionals conceive blockchain technology's impacts on regulation. Examples of this are self-regulation through bureaucracy and ERM. Three main conclusions came forward from my research. However, to properly use these conclusions I have to go back to the original research question of this thesis: "what are the ways blockchain technology can shape (and vice versa) the implementation of regulation in the banking sector according to financial professionals?"

First I want to address blockchain technology adoption and implementation in the financial sector. In chapter 4 the conclusion from the data was: "according to senior executives in the financial sector our immediate future will be more automated and there will be more opportunity and need for implementation of blockchain technology into the world economy and thus financial institutions. While these senior executives named blockchain technology a disruptive one for these reasons, not everybody in the field agreed with this statement, especially the ones that did not comprehend blockchain technology." This in the end forms a nuanced answer to the question if blockchain technology is going to be a disruptive one. However, it is safe to conclude from the data collected that it was widely acknowledged that blockchain technology will have (and already has) an effect on the financial sector.

Secondly, the focus of this thesis lies in the connection between blockchain technology and financial regulation. The result of this that came forth from the data was that "my respondents believe that due to the nature of blockchain technology, compliance and (self-)regulation can become easier in the banking sector. However, it might be an illusion that it will fundamentally change higher-level regulatory entities like Basel III. This then calls into question the disruptive power of the technology on a higher legislative level, but it can still be disruptive for the way the financial industry conducts their compliance at the moment and in the future (especially cost benefits and new business models)." This is especially so because the mandatory compliance happens before any action, which makes it in theory impossible to be 'incompliant'

with regulation. In that sense blockchain technology is shaping and influencing the implementation of regulation in the financial sector in a large manner.

Thirdly, as with the implementation of any new technology there are downsides and challenges. The conclusion about the challenges of the technology was: "according to the majority of my interview respondents the biggest challenge for the implementation of blockchain technology into the financial sector will be its inability to reach the plateau of productivity on the Garner scale. This is connected to adoption of the technology into the mainstream and its usage by financial institutions." As with almost any new technology there has been a lot of popular media coverage about blockchain. Some respondents called it a hype. However, in order for the technology to come out of the 'early adoption' stage and into the 'growth' and 'maturity' stage where mass adoption will happen, greater efforts need to be made. Efforts like regulatory sandboxes and more investments by large banks. These efforts will have to come from the financial sector itself and regulatory entities that are in charge of designing legislation and compliance guidance.

A final answer to my research question will then be it that while the technology is currently being gradually implemented, it is too early to identify how regulating entities are going to react to a widespread implementation of blockchain technology into the financial sector. Some professionals argue that regulating accords are not necessarily going to be changed because of the technology. While others argue that the technology will be implemented into the banking sector with regards to compliance and (self-)regulation without a large change in the actual legislation. In this case especially compliance and costs will benefit from the implementation. Senior executives are really enthusiastic about the technology and are passing through pilots and start-ups, while others in the industry do not see its relevance quite yet. There are clear projections about when blockchain technology will be adopted into the mainstream. However, it is important to realize that these are only projections.

5.2 Discussion

The previous three sub conclusions already take into account some of the more challenging sides of the implementation of blockchain technology into the financial sector and its regulation. These

three conclusions build to support my main argument because in order to answer such a complicated question, sub topics have to be studied. The first one was to understand what sort of environment blockchain technology would be implemented. The second topic was to comprehend blockchain's position in finance and regulation. Lastly, the third one helped to realize what sort of problems and issues the technology could run into. However, in this discussion section some critical questions will be asked regarding the possibilities of blockchain technology, and possible future research. During this research I have discussed banks, and how blockchain technology is different, how scholars have studied finance and banking regulation so far, as well as major potential areas of impact on self-regulation (ERM and bureaucracy).

5.2.1 Possibilities

My supervisor Jess Bier told me an amusing and interesting story about the possibilities of new technology and technology of the future. Science-fiction movies of the 1980s had predictions about how future technologies and societies might look (i.e. possibilities). However, the ideas they envisioned did not really come close to the reality. For instance computers pictured in those movies were still large machines with actual buttons. Nothing like our computers are now. Another example is the internet, this is such an advanced and progressive technology that it was not pictured in the eighties. The same mechanism can apply to blockchain technology: the people I talked to and the primary documents I consulted had a pretty similar idea of what the possibilities of blockchain technology and its regulation for the banking sector will entitle. Nonetheless, a prediction might in the end not be the actual reality. How can we/they now know what the possibilities are of this new technology? As discussed previously, power and control are large facets in the implementation or non-realization of possibilities in the sociology of finance.

Here I would like to refer to Nassim Taleb's (2007) book *The Black Swan*.⁸ Taleb makes the argument that professionals in the financial industry do not know more than they know, meaning that the unknown is far greater than the sum of their knowledge, but even so they like to overestimate what they do know. This can lead to skewed projections and expectations in the sector (like self-regulation). Next to this Taleb refers to so-called black swans which are totally

⁸ Here I would like to thank my supervisor Jess Bier for referring me to Taleb's book.

unpredictable events that can occur in financial institutions. These cannot be known or anticipated until they happen. Still, it is interesting to realize that because people in the financial sector believe blockchain technology is going to turn out a certain way, they will invest in it in a certain manner (control). Which in the end can make their predictions a reality (power). Again this should be taken with a side-note: there is a vast difference between what people say and actually do. That is also the case in the financial sector and the application of blockchain technology in it. But that is not to say that people who operate on more broad markets than the financial market develop severely different uses of the technology.

5.2.2 *Further research*

During my research it became apparent that the banking sector is a mainly male dominated branch. As such decisions and management stem from this. There is little diversity, which then in turn does not lead to nuance. Even when there is diversity, people in the sector try to look and think in similar ways. It would be very interesting to build upon work on gender in financial cultures (such as Blair-Loy's work "It's not just what you know, it's who you know: technical knowledge, rainmaking, and gender among finance executives")⁹ by researching the difference between male and female policy makers when it comes to the implementation of blockchain technology.

Another interesting study would be to conduct another thorough document analysis in 2025 when, according to most sources (Bussmann, 2017; Gartner, 2017; IBM, 2017) the technology will have reached the plateau of productivity, mass adopters have already adopted the technology, what has changed? Did it really go as fast as professionals anticipated. Was the technology really as revolutionary and disruptive as anticipated? And did trailblazers indeed benefit the most from their early adoption of the technology?

To conclude this academic work I want to note that there are still so many research possibilities when it comes to blockchain technology. The technology and its effect and influences are just beginning to be studied. Understanding how financial professionals react to

⁹ Blair-Loy, M. (2001). It's not just what you know, it's who you know: Technical knowledge, rainmaking, and gender among finance executives, in Steven Vallas (ed.) *The Transformation of Work (Research in the Sociology of Work, Volume 10)* Emerald Group Publishing Limited, pp. 51 - 83

new technologies can prove to be a valuable tool to better understanding the messiness of the banking industry. It can also provide non-academics with opportunities to better anticipate changes in world markets since the financial industry is essential to the process. I am curious what role it will fulfill for us in the coming 20 years. My final overall argument is that financial professionals' belief in the influence of blockchain technology can make it influential, however, not in predictable ways. The effects of power and the struggle for control involve a certain amount of unpredictability.

Reference list

- Abbate, J. (2000). *Inventing the internet*. Cambridge, MA: MIT Press.
- Barabasi, A. (2002). *Linked*. New York, NY: Basic Books.
- Basel Committee on Banking Supervision (2005, April). *Compliance and the compliance function in banks*. Retrieved from <http://www.bis.org/publ/bcbs113.pdf>
- Baxendale, G. (2016, March). Can Blockchain revolutionize EPRs? *ITNOW*, 38-39.
- Brewster Stearns, L., & Mizruchi, M. S. (2005). Banking and financial markets. In N. J. Smelser, & R. Swedberg (Eds.), *The handbook of economic sociology* (pp. 284-306). Princeton, NJ: Princeton University Press.
- Bussmann, O. (2017). *Blockchain – what is needed for a breakthrough?*. Retrieved from <https://nrclive.nl/wp-content/uploads/2017/05/Oliver-Bussmann.pdf?x75034>
- CapGemini (2017). *World FinTech report 2017*. Paris, France: CapGemini
- Carruther, B. G. (2005). The sociology of money and credit. In N. J. Smelser, & R. Swedberg (Eds.), *The handbook of economic sociology* (pp. 355-378). Princeton, NJ: Princeton University Press.
- Christophers, B. (2016). Geographies of finance III: Regulation and ‘after-crisis’ financial futures. *Progress In Human Geography*, 40, 138-148. doi:10.1177/0309132514564046
- Christophers, B. (2013). *Banking across boundaries: Placing finance in capitalism*. West Sussex, UK: John Wiley & Sons, Ltd.
- Clark, G. L., & Thrift, N. (2005). The return of bureaucracy: Managing dispersed knowledge in global finance. In K. Knorr Cetina & A. Preda (Eds.), *The sociology of financial markets* (pp. 229-249). Oxford, UK: Oxford University Press.
- Cummings, D. (2017, February 28). Regulatory Sandboxes: A Practice For Innovation That Is Trending Worldwide. Retrieved May 25, 2017 from <https://www.ethnews.com/regulatory-sandboxes-a-practice-for-innovation-that-is-trending-worldwide>
- DutchChain. (2014, October 14). De echte waarde van bitcoin en crypto-currency technologie: De Blockchain uitgelegd. [Video File]. Retrieved from <https://www.youtube.com/watch?v=gKC2oelL878&feature=youtu.be>.
- Forni, A. A., & Meulen, R. V. (2016, August 16). Gartner's 2016 Hype Cycle for Emerging Technologies Identifies Three Key Trends That Organizations Must Track to Gain

- Competitive Advantage. Retrieved May 15, 2017, from <http://www.gartner.com/newsroom/id/3412017>
- Fryde, E. (1950). Reviewed work: Money, banking and credit in mediaeval Bruges by Raymond de Roover, *The English Historical Review*, 65(254), 111-114. Retrieved from <http://www.jstor.org/stable/556557>
- Gartner (2017). Research methodology: Gartner hype cycle. Retrieved May 26, 2017 from <http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp>
- Helleiner, K. (1950). Medieval Money Dealers. *The Canadian Journal of Economics and Political Science / Revue Canadienne D'Economie Et De Science Politique*, 16(2), 242-247. doi:10.2307/137991
- Huckle, S., & White, M. (2016). Socialism and the blockchain. *Future Internet*, 8(49), 1-15.
- IBM Institute for Business Value (2016). *Leading the pack in blockchain banking: Trailblazers set the pace*. Somers, NY: IBM Corporation.
- Judd, E. (2016, March). Breaking down blockchain: What to know about the potential of the digital age data-ledger technology. *ICBA Independent Banker*, 102-103.
- Knorr Cetina, K., & Preda, A. (2005). *The sociology of financial markets*. Oxford, UK: Oxford University Press.
- Legrand, B (2017). *Transformation @ ING: Darwin re-loaded*. Retrieved from <https://nrclive.nl/wp-content/uploads/2017/05/Benoit-Legrand.pdf?x75034>
- Mattila, J. (2016). *The Blockchain phenomenon: The disruptive potential of distributed consensus architectures* (ETLA working papers, no. 38; ETLA working papers, Elinkeinoelämän Tutkimuslaitos no. 38). Helsinki: The Research Institute of the Finnish Economy.
- Mattila, J., & Seppälä, T. (2015). *Blockchains as a path to a network of systems: An emerging new trend of the digital platforms in industry and society* (ETLA reports, 45; ETLA raportit, Elinkeinoelämän Tutkimuslaitos 45). Helsinki: Elinkeinoelämän tutkimuslaitos.
- Power, M. (2005). Enterprise risk management and the organization of uncertainty in financial institutions. In K. Knorr Cetina & A. Preda (Eds.), *The sociology of financial markets* (pp. 250-268). Oxford, UK: Oxford University Press.

- Singer, D. A. (2007). *Regulating capital: Setting standards for the international financial system*. Ithaca, NY: Cornell University Press.
- Smelser, N. J., & Swedberg, R. (2005). Introducing economic sociology. In N. J. Smelser, & R. Swedberg (Eds.), *The handbook of economic sociology* (pp. 3-25). Princeton, NJ: Princeton University Press.
- Taleb, N. (2011). *The black swan: The impact of the highly improbable*. New York: Random House Trade Paperbacks.
- Press release (2016, August 16). Gartner's 2016 Hype Cycle for Emerging Technologies Identifies Three Key Trends That Organizations Must Track to Gain Competitive Advantage. Retrieved May 26, 2017 from <http://www.gartner.com/newsroom/id/3412017>
- Reijers, W., O'Brolcháin, F., & Haynes, P. (2016). Governance in blockchain technologies & social contract theories. *Ledger Journal*, 1, 134-151. doi: 10.5915/LEDGER.2016.62
- Smelser, N. J., & Swedberg, R. (2005). *The handbook of economic sociology*. Princeton, N.J.: Princeton University Press.
- Vigna, P., & Casey, M. J. (2015). *The age of cryptocurrency: How Bitcoin and digital money are challenging the global economic order*. New York, NY: St. Martin's Press.
- World Government Summit (2017). *Building the hyperconnected future on blockchains*. Dubai: World Government Summit.
- Wright, A., & De Filippi, P. (2015). *Decentralized blockchain technology and the rise of lex cryptographia*. Rochester, NY: Social Science Research Network.

Appendix 1: Key words and definitions

1. *Blockchain technology*: "the blockchain technology is a method by which parties previously unknown to one another can jointly generate and maintain practically any database on a fully *distributed* [emphasis added] basis. In reality, the system works so that each party is distributed a copy of the database (or part of it) who may then make changes to the database subject to collectively accepted rules. The changes made by the various parties are assembled and stored in the database at regular intervals as bundled packets called 'blocks'. When new blocks are added to the original database, they form a blockchain, or an up-to-date database containing all the changes made" (Mattila & Seppälä, 2015, p. 7).
2. *Fintech*: financial technology. Often used in the financial sector to explain that start-ups and new innovative technologies are connected to it. According to a CapGemini report (2017, p. 5) "FinTechs are the new financial services firms that are less than five years old and have a relatively small but growing customer base".
3. *Regtech*: regulatory technology. This refers to technologies that can be used to implement compliance and/or easy regulatory standards. Blockchain technology can be seen as RegTech since it can be used to comply with regulatory legislation.
4. *Compliance*: "compliance laws, rules and standards generally cover matters such as observing proper standards of market conduct, managing conflicts of interest, treating customers fairly, and ensuring the suitability of customer advice. They typically include specific areas such as the prevention of money laundering and terrorist financing, and may extend to tax laws that are relevant to the structuring of banking products or customer advice. A bank that knowingly participates in transactions intended to be used by customers to avoid regulatory or financial reporting requirements, evade tax liabilities or facilitate illegal conduct will be exposing itself to significant compliance risk" (Basel Committee on Banking Supervision, 2005, p. 7).
5. *Regulatory sandboxes*: "regulatory sandboxes usually implement a set of rules that allow trailblazers to test their products and business models in a live environment with minimal legal requirements" (Cummings, 2017, n.p.).

Appendix 2: Summaries interviews

- Interview 1: (Large European bank, male, end 20s, innovation expert at innovation center, Amsterdam 09-05-2017, 10:00-11:30)
- Interview 2: (International financial consultancy firm, male, 55-60, former CIO of large Swiss bank, blockchain technology expert, Amsterdam 11-05-2017, 11:20-11:45)
- Interview 3: (International financial services firm, female, 45-55, banking leader and partner PwC, Amsterdam 11-05-2017, 13:45-14:00)
- Interview 4: (Dutch Authority on Financial Markets, male, 50-55, program manager innovation and FinTech, Amsterdam 11-05-2017, 14:55-15:15)
- Interview 5: (Large Dutch bank, 40-45, male, innovation manager, Amsterdam 11-05-2017, 9:30-10:00)
- Interview 6: (Large French bank, male, 40-50 years old, financial lawyer specialized in banking law and payments, Paris 05-06-2017)
- Interview 7: (Large French bank, male mid 20s, employee macro prudential department, Paris 05-06-2017)
- Interview 8: Large European bank, male mid 20s, economy apprentice risk analysis, Paris, 06-06-2017)
- Interview 9: (Large European bank, male, end 20s, blockchain project management officer, Amsterdam 12-06-2017)
- Interview 10: (Large French bank, mid 20s, male, legal intern in the innovation department, Paris 06-06-2017)
- Interview 11: (Larger French bank, mid 20s, male, legal intern in the IT department, Paris 06-06-2017)
- Interview 12: (Financial services firm, 40-50 years old, male, managing director, Amsterdam 11-05-2017, 8:15-8:30)
- Interview 13: (Large Dutch bank, 55+, male, account manager, Amsterdam 11-05-2017, 8:30-8:45)
- Interview 14: (Medium Dutch bank, 40-50 years old, male, IT manager, Amsterdam 11-05-2017, 8:45-9:00)
- Interview 15: (Medium Dutch bank, 25-35, male, asset manager, Amsterdam 11-05-2017, 14:30-14:45)

Appendix 3: Document analysis matrix

Document	Approach / reason of document	Financial institutions: adopters of technology	Investment areas in financial industry	Current situation in finance	Threats financial industry
IBM executive report 2017	1. Analysis of 200 banks in 16 countries regarding the experiences and expectations of BCT ¹⁰ (p. 1)	1. The adopters of BCT defy common reasoning: larger banks (> 100.000 employees) are leading in the adoption of BCT (pp. 1-2) 2. New cross-industry ecosystems will emerge (p. 11)	1. Trailblazers are investing in areas where they expect disruption (and benefit): trade finance, corporate lending, and reference data (p. 1)	1. In 2017 15% of banks expect to have BCT in commercial production (pp. 1-2) 2. Banks are currently conducting pilots (p. 5) 3. The adoption of BCT is accelerating faster than originally anticipated (p. 1)	1. The peer-to-peer model can damage incumbent banks that move too slowly (p. 9) 2. BCT is viewed as immature by more than half (54%) of the organizations interviewed (pp. 13-14) 3. The regulatory complexity and constraints seem the biggest barrier to adopt BCT (p. 13)
World Government Summit: Dubai report 2017	1. To provide a fresh perspective on current (02-2017) state of BCT benefits and adoption by governments (p. 2)	1. The state to regulate easier (p. 7)	1. Manual and human coordination of the economy cannot scale, but BCT can (p. 9) 2. Automatic auditing (p. 10) 3. Internet of agreement (p. 10)	1. Secure record keeping is a core competence of the state, BCT is a natural fit for the needs of the state (p. 7) 2. BCT field is maturing rapidly past the initial pilot stage (p. 13)	1. Making regulations legible to computers is a long and extensive journey (p. 12)
World FinTech Report 2017	1. to establish if FinTech is going to be disruptive for the financial sector (p. 5)	1. Traditional financial sector firms (in-house and seeking partnerships) (p. 9)	1. Preparing for future disruptive scenarios such as BigTech and platformification (p. 9) 2. BCT solutions related to payments are going to be the first implemented	1. Early adopters (pilots) of the technology are currently using BCT for payment authorization, clearing and settlement, and cross-border payments (p. 30)	1. Despite all the activity, the industry as a whole is still struggling to understand blockchain. Most financial services executives (60%) display only a basic understanding of blockchain technology and less than 10% feel they have a very good understanding (p. 31)

Document	Expectations of technology (regulation)	Benefits of technology (for banks and regulators)	Recommendations for regulatory measures
IBM	1. New business models for	1. In general time, costs, and risks of	1. Regulators have been

¹⁰ BTC: from here on out BTC refers to blockchain technology

<p>executive report 2017</p>	<p>trade finance, corporate lending, and reference data (p. 1) 2. BCT will eradicate frictions that lead to limited growth and innovation (p. 3-4) 3. A near unanimous answer was given by banks: BCT will provide benefit in every aspect of banking (p. 5) 4. Banks can regain lost ground that was taken away by other parties: digital start-ups, FinTech, and non-financial institutions (p. 10)</p>	<p>transactions will go down (p. 1) 2. The reaching of new markets (p. 1) 3. There will be an increase in information, innovation (regulation-wise), and interaction (pp. 3-4) 4. The benefits for trailblazers on: reference data (83%), retail payments (80%), and consumer lending (79%) (p. 5) 5. There will be more data integrity due to BTC (p. 6) 6. BCT will not be bound by complex regulation (p. 6) 7. BCT will increase efficiency: eliminates time, labor, and errors (p. 6) 8. Lenders in new markets (p. 6) 9. Enhanced identity (p. 6) 10. Know your customer KYC (p. 6) 11. BCT will improve profitability of financing and acquisition of new clients (p. 8) 12. BCT encourages trust therefore organizations can expand the number of enterprises with which they transact (p. 11)</p>	<p>welcoming to banks for regulation design. Here there are openings to influence this (p. 13) 2. Banks now have the chance to influence regulation 3. It is important to actively establish business standards, form consortia, and build partnerships to support a better understanding of BCT (pp. 13-14)</p>
<p>World Government Summit: Dubai report 2017</p>	<p>1. BCT allows for fair play in a globalized and decentralized world based on three principles: everywhere is the same, the record is permanent, and nobody is in charge (p. 6) 2. It can provide working smart contracts (p. 7) 3. BCT provides an open opportunity to begin the economic transformation of the global economy (p. 13) 4. Legal experts suggest the legal system must develop the capacity to understand the intent behind code (p. 18)</p>	<p>1. The global economy will experience reduced transaction costs, increased security, innovation in the global systems of trade, increased reliability and trust in every aspect of life (p. 2) 2. BCT is a single source of trust (p. 7) 3. Because of the computer power of BCT, countries can keep their regulation framework and overarching regulations like the EU are no longer necessary (p. 12) 4. Automated bureaucracy (p. 9)</p>	<p>1. Policy-wise: for governments to create working groups, support regulatory environments, facilitate standards and interoperability, improve compliance and regulation (p. 17)</p>
<p>World FinTech Report 2017</p>	<p>1. Enhanced transfers of digital assets (p. 30) 2. Identity management (p. 30) 3. Better management of reward and loyalty solutions (p. 30) 4. Notarization services (p. 30) 5. Letter of credit processing in banking (p. 30)</p>	<p>1. Simplified ecosystem via common ledger (p. 30) 2. Security from fraud and tampering of records (p. 30) 3. Decentralized and transparent operations (p. 30) 4. Increased speed (p. 30) 5. Low cost of operations (p. 30)</p>	<p>1. For the implementation of BCT into a financial institution a three step approach is recommended: (a) adopting a step-wise approach for applying innovation, (b) securing senior leadership commitment, having a clear vision, and adopting a more innovative culture will be important for addressing</p>

	<p>6. Payment authorization and clearing in payments (p. 30)</p> <p>7. Automation of claims processing and peer-to-peer insurance in the insurance industry (p. 30)</p>		<p>disruption, (c) and financial services firms need to be prepared for prospective future disruptive scenarios.</p>
--	---	--	--

