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Confronting the Blockchain

A Multi-Level Perspective on

Incumbents' Active Involvement in Disruptive Niche Innovations

Based on the Case of Blockchain Technology in the Financial Sector

"I can't count the number of people I've met for whom finding out about Bitcoin was like finding religion, who subsequently plunged into months of research at the expense of their sleep, their work, and their relationships, and who finally left their jobs to follow the siren call of Satoshi Nakamoto"
-morgenpeck

"We've entered the most profound era of change for financial services companies since the 1970s brought us index mutual funds, discount brokers and ATMs. (...) The blockchain is a wild card that could completely overhaul financial services. Both major banks and startups around the world are exploring the technology (...) This technology could lower the cost of many financial activities to near-zero and could wipe away many traditional banking activities completely."
-Andrew Meola, in Business Insider

'

Keywords
Empowerment patterns; Transition pathways; Socio-technical transitions; Blockchain; Finance.

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Abstract

Within innovation studies, progress has recently been made on how pathways for socio-technical transitions are enacted through struggles between actors. The focus has been on the enactment of ongoing transitions, initially set about by external factors. This thesis explores how transitions can be initiated, from the perspective of actor struggles, with a focus on incumbents. It aims to explore connections between enacted innovation activities before a transition has been initiated, and the subsequent transition pathways. Through studying a case where both incumbents and niche actors engage in innovation activities of a technology that is perceived as truly disruptive, different strategies for making the innovation competitive are explored. Blockchain technology within the financial sector is used as case. Based on a varied set of qualitative data, three separate analyses cover: a Multi-Level Perspective on the case context, the narratives of the actor-groups regarding the technology, and the technological solutions they develop. The analysis shows that the incumbents follow a 'fit-and-conform' pattern, aiming to reconfigure blockchain technology into a performance-enhancing substitute to existing technologies that fits regime structures. In contrast, the niche actor's employ a 'stretch-and-transform' pattern, maximising the technology's disruptive potential, aiming to decentralise power structures and even make banks obsolete. The study discusses what these patterns mean for the enactment of transition pathways. The findings that incumbents and niche actors employ different empowerment patterns, and that these patterns play different parts in the enactment of transition pathways, suggests that the engagement by incumbents in blockchain technology can have significant affects on the future trajectory of the regime. These findings are used to build an illustrated model for enacted transitions that integrates the transition pathways and the empowerment patterns. The model is explained and made to illustrate observed patterns in the case. The study concludes that incumbents under certain circumstances actively take part in development of disruptive technologies, which in this case leads to a less disruptive technology. This differs from the normal assumption that incumbents are locked-in and path-dependent, but corroborate with other recent findings in the transition literature (Smith, 2006; Geels et al., 2016). The implication is that lock-in and path dependency in incumbents can not be assumed, but should be determined through contextual analysis.

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If you find the topic interesting, I can recommend the reader to start their blockchain-jouney with the TED talk from Don Tapscott: “How the blockchain is changing money and business” for a inspiring introduction.

And to Satoshi Nakamoto, if you ever read this, thank you and stay low!

Glossary and abbreviations

BCT: Blockchain Technology, a kind of distributed ledger technology, the term mostly used by niche-actors.

Bitcoin (capital B): Singular with an upper case letter B, refers to the protocol, software and community

bitcoin (lower case b): Refers to the currency and units of the currency.

Block: A grouping of transactions made within a certain time frame and hashed to produce a proof of work. Blocks are added after each other in a chain of blocks.

Blockchain: A list of validated blocks, each linking to its predecessor all the way back to the first “genesis block”.

DLT: Distributed Ledger Technology, the term for 'blockchain technology' mostly used by regime actors, but also wider in its definition. A blockchain is a distributed ledger, but a distributed ledger is necessarily not a blockchain.

Fit-pattern: Fit-and-conform empowerment/development patterns.

Fintech: Short for 'financial technology' and the industry sector that deals with such technologies.

Hash: A unique 64-character code, or 'digital fingerprint' one can get out from some binary input/file. We do not know any way to reverse this and create the content from the hash, while it is easy to create the hash from the content.

Miner: A network node that finds valid proof of work for new blocks, by repeated hashing.

MLP: The Multi-Level Perspective

Peer-to-peer network: A network that propagates transactions and blocks to every bitcoin node on the network.

Permissioned blockchain: Blockchain with barriers to enter, privileged or administrative users who are given certain sanctioned roles and who can assert power over the system, like being allowed to process transactions, mine blocks, freeze funds or accounts and blacklist users.

Permissionless or non-permissioned blockchain: A blockchain where there are no privileged or administrative users, as opposed to permissioned blockchains.

Private blockchain: A closed blockchain where only certain entities can access data and submit transactions.

Proof-Of-Work: A piece of data that proves that significant computations have been made to find it. In bitcoin, miners must find a numeric solution to the SHA256 algorithm that meets a network-wide target, the difficulty target.

Public blockchain: A blockchain where there are no restrictions on reading data and submitting transactions to the blockchain.

RSE(s): Regime Selection Environment(s)

Stretch-pattern: Stretch-and-transform empowerment/development pattern

STT(s): Socio-Technical Transition(s)

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1 Introduction

1.1 General Background

The accelerated speed of technological development due to digitization poses challenges for societies and policymakers. As more of the functions and services our society delivers are based in a more fluent, digital environment, rapidly developing technologies now have the potential to disrupt not only industries, but also important institutions across our society. Such disruption can drastically improve some societal functions, but they simultaneously involve changes that are hard to adapt to, and can hence cause other functions to collapse. In order to achieve a sustainable society we need not only transition to ecologically benign technology, we also need to be able to manage other socio-technical transitions in such a way that crucial functions of our society are maintained and improved. There is hence a need for developing conceptual understanding of transitions and the role that disruptive, digital technologies, as well as established industries and incumbents, have in these processes.

1.2 Position in Literature

Understanding how socio-technical change comes about has always been central in the field of innovation studies. The dominating perspective since the 1980s is a systemic one, recognizing that firms and technologies are embedded within wider social and economic systems. In this tradition, the unit of analysis is often a whole system of actors, technologies and institutions. The systemic units can be defined and studied in many different ways: one can try to optimize them or overthrow them and one can look at national, technological, sectoral systems and so on. (For a review of this literature, see Fagerberg et al. (2011, chapters 1 & 7) and Rip & Kemp (1998).) A popular model that builds upon the systemic tradition is the Multi Level Perspective (MLP), and the related 'strategic niche management' (Geels, 2002; Geels & Schot, 2007; Kemp et al. 1998; Smith et al. 2010). This specific sub-field of *transition studies* has a strong tradition of studying transitions related to sustainability, especially towards 'green' technologies (e.g. Geels, 2014; Geels et al., 2016; Kemp et al., 1998; van der Vleuten & Raven, 2006; Verbong & Geels, 2007; Verbong, Geels, & Raven, 2008; Verbong & Geels, 2008; Nykvist & Whitmarsh, 2008). This means that many case studies have several shared attributes.

This study contributes to the lesser studied side of this divide by focusing on a disruptive,

digital technology, that has very different traits from typical green technologies, but that can cause fundamental changes in our society.

According to MLP, path-breaking innovations develop in secluded *niches.* Changes in the surrounding socio-technical *landscape*, put pressure on established socio-technical configurations called *regimes*. This causes destabilization of the regime and a window of opportunity for the niche-innovation to enter the regime. As a result, there might be a socio-technical *transition* (STTs, or simply 'transitions') to a new regime (Geels, 2002; Geels & Schot, 2007). As a part of this theory, Geels (2014) has conceptualized regime stability as the outcome of active resistance by incumbent actors. Incumbents are understood as actively resisting disruptive technologies, often using their power to sustain status quo and periods of incremental innovation. This seems to be well grounded in empirical studies and the concept of regime stability, inertia and lock-in can be seen in many classic authors under different labels within innovation studies (Fagerberg et al., 2011, pp. 12–14, 180–208; Hughes, 1987; Page, 2006; Unruh, 2000). However, when incumbents are facing disruptive innovations there are also other options for action and they sooner or later need to commit to other strategies than resistance if a transition takes place, to avoid being disrupted. While studies on incumbent performance and factors related to their success or failure in the face of disruptive innovations are abound (Ansari & Krop, 2012), less attention has been paid to the diversity of strategies employed by incumbents in the MLP literature. I argue that there seems to be a lack of nuance in MLP literature regarding the role of the incumbents in STTs. The exceptions to this comes from: Geels & Schot (2007), who develops four different 'transition pathways' where incumbent agency is developed; And Geels et al. (2016) who, develop the transition pathways with more focus on how pathways, and shifts between them, are enacted as struggles involving both niche and regime actors. Less clear in their conceptualization, is whether the enactment is of equal importance also in *initiating* a transition. Their logic still relies much on transitions being initiated by *outside forces*. This thesis follows their suggestion on further research, that "*pays attention to ongoing struggles between actors over institutions and technology deployment"* (Ibid., p. 911). It also aims to explore how 'struggles between actors' are important in the *initial* phase, or even *before* a transition. It does so by exploring niche-regime 'struggles' over a disruptive technology, in a pressured regime, rather than studying a historical transition.

Another central contribution to this field is the concept of 'niche empowerment patterns', describing ways in which a niche innovation becomes competitive within the selection environment of an established regime (Smith & Raven, 2012). Although Geels et al. (2016) integrates these concepts in one of the transition pathways, the connections between the empowerment patterns and

the transition pathways have, to my knowledge, not been elaborated further in the literature. Especially not when it comes to how *incumbents* employ niche empowerment patterns to make disruptive innovations competitive within an established regime, and how this affects the trajectories of technologies and industries. That is what this study contributes to.

1.3 Aims, Research Questions, Approach

The aim of this study is to contribute to the general issue of how STTs take different shapes and directions depending on how they are enacted. The focus is on incumbents, and how their actions differ from niche actors, when facing disruptive niche technologies, and the effects this may have on the technology and the socio-technical regime. Wide and exploratory issues as this one are suitable to approach through a case-study, which also provides necessary limitations (Yin, 2013, p. 49). Therefore, the 'ongoing struggle between actors over technology deployment', is studied through the case of how 'blockchain technology' is developed and empowered within the socio-technical system of finance, by both regime- and niche-actors. Blockchain technology is the technology behind Bitcoin, a kind of digital cash traded on a peer-to-peer network. Beyond Bitcoin, blockchain technology has many applications within finance (described in Chapter 2.4 and Chapter 4). The comparative element aims to make different kinds of niche-regime interactions visible and understood in relation to one another. The general issue is hence operationalised into a specific research question that will be addressed in three different analytical steps:

> *How is blockchain technology developed and empowered within the socio-technical system of finance by different actor-groups?*
>
> - ***a.*** *What are the multi-level interactions active in such a process?*
> - ***b.*** *What narratives regarding blockchain technology the niche actors and incumbents present?*
> - ***c.*** *How do the blockchain technologies Corda and Bitcoin relate to the selection environments of the financial regime?*

The first step addresses the research question at a contextual level, through a heuristic, contextual analysis of the case in MLP terms. The next step addresses it at a discursive level through a thematic analysis of the narratives that the different actors use to frame the technology. The last step focuses on the technological level by comparing two strategically chosen and contrasting blockchain designs: Bitcoin and Corda. The hope is that this will capture these complex processes from more than one angle and give a nuanced picture of the interactions that are played out.

Even if blockchain technology is a new phenomenon and it is uncertain how it eventually will be utilized, the research question should not be seen as speculative. The narratives and the technological designs are there to be studied, even if neither of them eventually reaches mainstream adoption in their current form. Another critique that may arise is that transitions are slow and complex processes that are difficult to identify until they can be observed in light of history. Therefore it is not argued here that there will be a transition in this case, but it is argued that *if there is*, the initial processes that we *can witness now,* will be crucial to how it plays out. If some sentences suggest that there will be a transition, this should be interpreted as a *possible* transition.

It has been common in this field to adopt an 'outsider ontology' or 'outside-in' perspective, where the unit of analysis is the transition itself and the analyst often takes a managerial perspective and view the case as an object to be developed or changed (Smith & Raven, 2012, p. 1026, Geels et al., 2016, p. 897). The thesis rather follows the latest developments and adopts an 'insider ontology' or an 'inside-out' perspective (Ibid.), observing these processes as they are played out, aiming to add to the understanding of how STTs take different shapes and directions depending on how they are *enacted* and played out as struggles between different actors.

Even if the study might be relevant to both incumbents and entrants in the financial sector, it is situated in the *social* dimension and the reader should not expect technological conclusions or recommendations. The thesis is primarily aimed at transition scholars, rather than industry actors.

1.4 The Case

The financial system, with banks as important incumbents, has roots stretching back to early civilization and in a more modern form at least since the 16th century (Goodhart, 1988). Due to this long history, banks have become so deeply woven into how our society and how the economy functions that we can hardly imagine what it would be like without them.

However, in the eyes of a MLP analyst, there seems to be a paradoxical situation in this industry, since banks are experimenting and investing heavily in a new technology that is said to be able to disrupt them and even make them obsolete; namely *blockchain technology* (fact box, p. 9),

At the same time as the banks are experimenting with this technology, the ecosystem of startups and possible disruptors surrounding it are expanding rapidly. It seems like incumbents, entrants as well as activist communities are pushing these technologies. This situation raises a multitude of questions about why the banks are developing a technology that might disrupt them: Why are they getting involved? Are they concerned about disruption? How do the banks' innovation activities differ from how other actors developed the technology?

Fact Box: Blockchain Technology
Blockchain technology is the enabler of digital, decentralised currencies like Bitcoin, but can do much more than that. Through a combination of cryptography and economic incentives for users to support the network security process, it makes it possible for a network to manage a ledger-like database in a distributed rather than centralised way. This means that all participants in a network can have their own copy of the ledger, without ending up with conflicting versions. It is therefore also referred to as *distributed ledger technology* (DLT). All transactions to the ledger within a certain time frame are bundled up in a 'block'. Those blocks are then organized in a continuously growing chain of blocks, a blockchain, hardened against tampering and revision. The blockchain can keep a record of assets of any kind; bitcoins, stocks, physical goods, financial instruments, legal contracts or even executable computer code that makes up a virtual, programmable computer. This makes it a *general purpose technology* with potential to become game changing for the structure, future development and innovation activity within many sectors and industries (Ali et al., 2014; Buterin, 2014; Davidson et al., 2016; Swan, 2015).

Reliable databases are crucial for many institutions and organizations in society; for example voting systems, registries for property ownership, monetary transactions, residency, birth certificates and so on. Up until now, they have always been *centralised* due to mediation problems between ledgers and relied on a trusted authority that protects and manages the database. Other actors need to trust this authority but often have to keep their own ledger as well. Such trust in authorities might seem feasible in well functioning countries, but where corruption, political instability or hacker attacks exist, a centralised system is inherently vulnerable and not always trustworthy. BCT can deeply disrupt systems like these by making the central ledger and the institutions and authorities needed to guarantee it obsolete, or completely changing their roles. These abilities to disintermediate central authorities, support new power structures and build systems resistant to censorship makes BCT an *inherently political technology* (Winner 1980).

The most obvious applications for BCT is for handling value, which is why it is important within the financial sector and often called 'the Internet of value'. The financial sector contains many centralized systems for recording and managing transactions and a lot of resources are spent keeping their ledgers updated, synchronised and safe and to communicate their content. (More on how BCT works in chapter 4.2)

This makes the financial sector's adaptation and confrontation strategies to BCT a suitable case for the aims of this thesis. The incumbents, primarily banks, are compared to the 'niche actors', described as the 'blockchain community': a diverse group of startups, enthusiasts, activists, users and developers, who often have interest in the technology's disruptive potential, primarily based on ideological grounds. The analysis regards how these actors employ different strategies, i.e. empowerment patterns, to make blockchain applications competitive compared to regime alternatives (Smith and Raven, 2012), and further discusses how these patterns relate to different transition pathways (Geels et al., 2016; Geels & Schot, 2007).

The financial sector is the one sector most acutely affected by BCT and where it first influences mainstream industry. It is argued here that a successful early shaping process in the financial sector is important for determining the future role, understanding and envisioning of what the technology is and what it can do. This argument is based on the theoretical insight that successful innovations often come with some degree of irreversibly and exclusion of alternative solutions, eventually establishing a socio-technical regime. As Rip & Kemp (1998, p. 338)

explains; *"The adoption and diffusion of a technology result in decreased uncertainty regarding its actual capabilities, performances, and interdependencies—technical as well as social. In turn, this leads to some standardization. From these processes of adoption and standardization, irreversibilities emerge."* Consequently, the early phase, where a new technology is negotiated and shaped to fulfill a certain purpose, can be crucial for forthcoming socio-technical transitions. It is still acknowledged that the technology later can take different and unexpected development paths. In fact, one of the main points in this study is that socio-technical transition are heavily determined by the endogenous enactment and struggles. Also, that these processes start already *before* the transition starts.

The rationale for using the case is the combination of a regime that may be at the onset of a transition, with strong incumbency and the ongoing development of a disruptive niche technology in which incumbents take an active part. This combination of traits provides a good basis for discussion on central MLP-concepts and interactions. This could either confirm, challenge or extend the theory by suggesting alternative or reformulated explanations (Yin, 2013, p. 47). The case is explored through a wide set of qualitative data, such as official documents, interviews with central actors, conference presentations and panel discussions, forums, blogs and podcasts. The data are analysed with descriptive/interpretive text analysis methods, both inductive thematic analysis and with pre-set codes derived from theory (Braun & Clarke, 2006; R. Elliott & Timulak, 2005).

1.5 Structure of the Paper

The following chapter gives a theoretical foundation and a review of relevant literature.

Chapter 3 is devoted to describing and critically evaluating the research design and the methods used for collecting and analysing data.

Chapter 4 presents the case and gives a more detailed description of BCT and its role in the financial sector. The aim is to make it easier for those not familiar with the technology to understand the thesis. The actors and technologies used in the analysis are also presented.

Chapter 5 presents the analytical framework, defines the case in terms of theoretical concepts and then moves on to the three different parts of the analysis.

Chapter 6 discusses the analysis in the light of the literature, aims to answer the research question more directly and in doing so draws conclusions about what this means in a wider perspective. Implications and further research is suggested.

2 Theory and Literature Review

This chapter presents the MLP theory and the concepts that make up the theoretical framework that is needed to analyse the case and answer the research question. It starts off by introducing the MLP and each of its levels and from there look more at the interactions and dynamics. This also reflects how these concepts are used in the analysis; It starts wide with the context and eventually narrows down to finer granularity. The operationalisation of the theory in this chapter is presented at the start of the analysis chapter.

2.1 The Multi-Level Perspective on Socio-Technical Transitions

MLP is a theory that combines elements from evolutionary economics and science and technology studies (Geels, 2002). From evolutionary economics it combines two different views of technological evolution (Ibid.): The view that it is a process of unfolding and reconfiguration, where new combinations set technologies on certain pathways or trajectories (Schumpeter, 1934) and the view that it is a process of variation, selection and retention and where there is strong inertia due to 'technological regimes' (Nelson & Winter, 2009). From science and technology studies it takes the view that technologies can only be understood in a meaningful way through their context and co-evolution with social phenomenons and actors (Bijker, 1995; Geels, 2011).

There is also an extensive body of literature on technological or sectoral innovation systems that can be fruitful for studying disruptive technologies and socio-technical systems (Markard & Truffer, 2008). Much of this literature focuses on the functioning of these systems and how they change (Bergek, et al., 2008; Jacobsson, 2004). Verbong and Geels (2008, p. 1026) describes that the technological innovation systems literature "*focuses on the actors and learning processes in new technologies, but pays less attention to existing technologies and regimes"* Since the concern here is the relationship to the existing regime, MLP is seen as the preferred theoretical framework. It specifically "*looks at interactions between niche innovations and existing regimes, situated in a broader environment"* (Ibid.)

The ”S” (for *Social*) in STT means that the MLP considers not only changes in technology, but also in social aspects such as user practices, regulation, industrial networks, infrastructure and culture. It is a recognition that individual firms and technologies are limited in their ability to set about socio-technical change since they are embedded in a wider social and economic system (Rip

& Kemp, 1998). Hence, STTs are seen as complex, non-linear, long-term processes involving multiple actors. (Geels, 2002).

The 'multi level' means the inclusion of three different levels of aggregation, and how they interact, into the same model. These are the landscape, the regime and the niche level, illustrated in figure 1. These are not ontological descriptions of reality, but analytical and heuristic concepts to understand the complex dynamics of STTs (Geels, 2002).

The definition of an STT is a change from one socio-technical regime to another and the regime-level therefore have a central position in MLP (Geels & Schot, 2007).

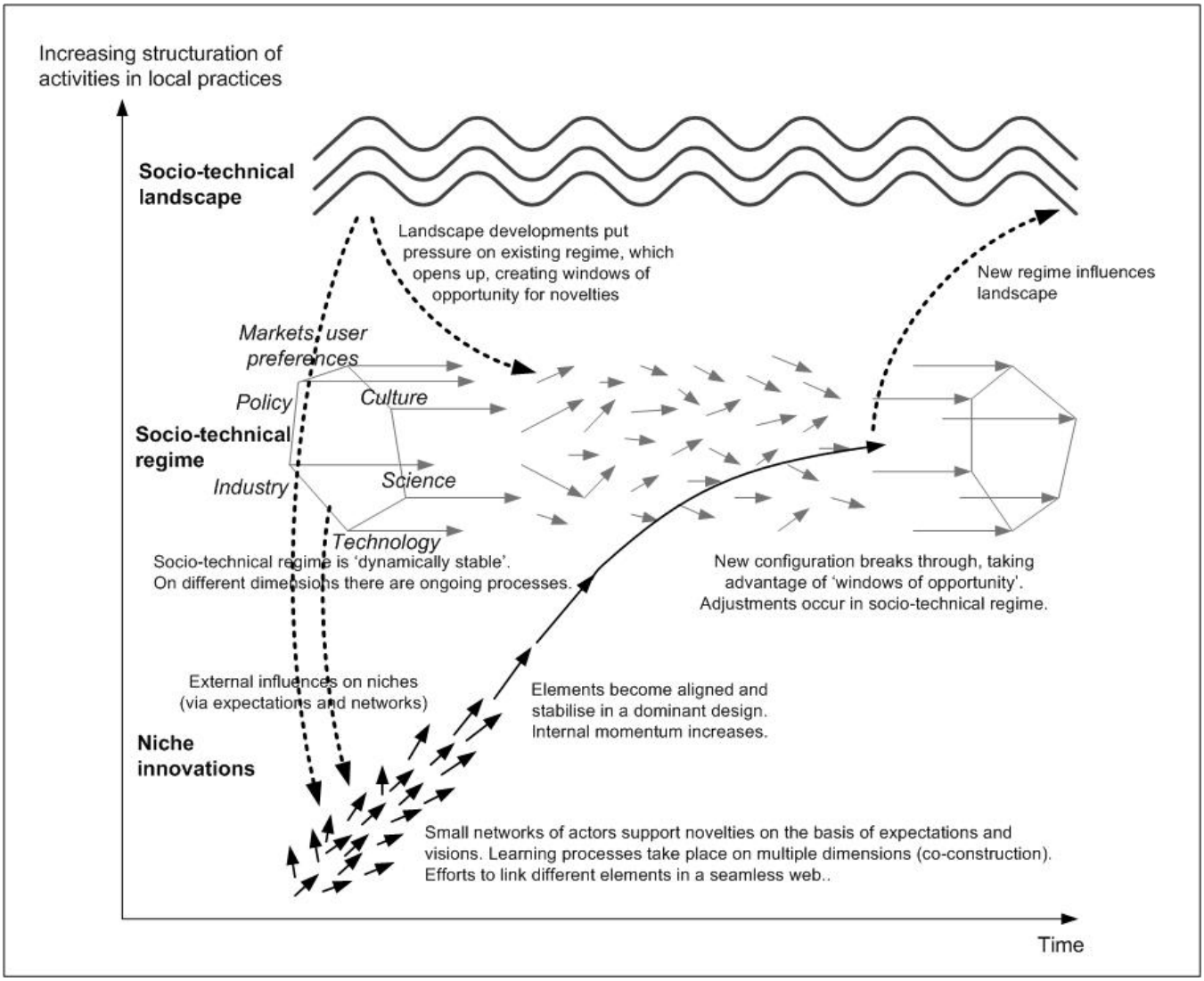

Figure 1. The Multi-Level Perspective on Socio-Technical Transitions. Source: Geels & Schot (2007, p. 401)

2.2 The Landscape Level

The landscape level is the highest in aggregation, representing the exogenous socio-technical environment under which a transition is taking place. It consists of broad political, social and cultural norms and institutions that create structural frames for a society and influence the dynamics of the lower levels. Landscape features could be, for example, the financial crisis, political ideologies or climate change (Geels, 2011). They are normally slow processes, but sometimes 'shocks' and faster processes occur. The basic theoretical understanding is that changes in the landscape put pressure on established regimes and force them to change. Geels (2011) also points out the importance of considering stabilizing as well as destabilizing landscape trends.

2.3 The Regime Level

Below the landscape level is the socio-technical regime. It has been described in slightly different ways by different authors but can be summarized as a relatively stable configuration of institutions, techniques and artefacts, as well as rules, practices and networks. These form a structure that set norms for development and use of technologies (Rip & Kemp, 1998). Regimes have also been described as *"the semi-coherent set of rules that orient and coordinate the activities of the social groups that reproduce the various elements of socio-technical systems"* (Geels, 2011, p. 27). It is an extension of Nelson & Winter's (2009) concept 'technological regime', referring to shared cognitive routines among a community of engineers. The regime forms the structure that accounts for the stability of an existing socio-technical system (Geels, 2004; Smith et al., 2010).

Even if each level has equal descriptive importance, the regime level is central in MLP in the sense that this is the level where there is a transition from one dominant structure to another. In cases of normative system management, it is the regime that policymakers or some social groups wishes to change or abandon (Geels, 2002). In this, and in similar cases, the goal would rather be ensure a smooth transition, with sustained societal functions.

2.3.1 Regime Selection Environments and Regime Stability

Seen in more detail, the regime has been described as consisting of a set of self-reinforcing 'regime selection environments' (RSEs) in central MLP literature (Geels, 2002; Geels & Schot, 2007; Smith & Raven, 2012). The RSEs are *"a structure of interrelated factors that feed back upon one another, the combined influence of which gives rise to inertia and specific patterns in the direction of technological change"* as Kemp et al. (1998, p. 181) writes, and *"not a set of factors that act*

separately as a containment force." The factors are: *technologies and infrastructure, industry, science and knowledge, markets and users, policy and regulation* and *culture* (Geels, 2002; Geels & Schot, 2007; Smith & Raven, 2012). How these are demarcated differs somewhat from writer to writer, but the important common idea is that they make up a structure of interrelated factors (see for example Kemp et al., 1998). The terminology and descriptions used here is mostly adopted from Smith & Raven (2012, p. 1026). Each RSE is marked in **bold**.

The established and dominant **technologies and infrastructure** in a regime form a very concrete selection environment for a path-breaking niche technology. New technologies might not be compatible with existing components and structure and will hence function sub-optimally. Established technologies have co-evolved with the selection environment and therefore have a competitive advantage.

The structure of the **industry**, with its network of relationships, have coevolved over long time periods. Incumbents and their routines, heuristics and capabilities therefore fit each other and are optimized for the dominant technologies. Entering into such an industry with a technology that potentially breaks these structures or that does not play to their strengths is obviously difficult.

Established **knowledge** patterns are socio-cognitive processes that make build-up of a new knowledge base hard. It is much easier to think, innovate and do research that is incremental rather than radical. A path-breaking innovation must work within and against an established knowledge base that has co-evolved with the dominant technologies. It will have less resources, institutions and proven history to support it. On the other hand, there is often more prestige in developing new and paradigm-shifting knowledge once it reaches a certain threshold and tips over.

Established **markets and user practices** form a similar self-stabilizing RSE within the commercial arena. Value chains, business models, markets, customer habits and demands have all co-evolved with established technologies. Breaking these patterns can be both costly and challenging. Customer habits might have to change to create a new demand. But with infantile supply, novel technologies are often neither cheap nor readily available and so struggle to change customer behaviour.

A similar situation can be seen within the **regulatory framework and public policies**, that are well aligned with dominant designs and the incumbent industries. New innovations might sometimes exist in regulatory grey-zones with an uncertain future. In addition, politicians are inclined to support incumbent industries and maintain a status quo since it is tempting, and popular, to preserve existing jobs and tax-incomes and thereby votes. Nobody will miss the jobs and industries that might be created in the future, and so few voices speak for them.

Culture is the RSE explained as the set of ideas, customs and behaviour we attach to some features of a regime, such as daily habits and consumption patterns. Many such features have a widespread symbolic value and appreciation. Our way of life has co-evolved with dominant regimes and hence they reinforce each other. Radical innovations often break these patterns one way or another, representing different values or simply lack the support of current shared values.

Together we see that the RSEs provide a harsh environment for a young, path-breaking innovation, but provide a solid structure for the dominant technologies employed by the regime. Adding to this concept of regime stability is Geels (2014). Rather than conceptualizing incumbents as locked-in, path-dependent and inert and hence automatic, they are seen as *actively resisting* socio-technical change that is not symbiotic with the regime. The basic idea is that policymakers and incumbent firms are *"often forming a core alliance at the regime level, oriented towards maintaining the status quo (...) because of mutual dependencies."* (Ibid. p. 26) Similar concepts have also been development elsewhere, like 'techno-institutional complex' (Unruh, 2000) and 'historical bloc' (Gramsci & Hoare, 1985).

Due to the alignment of the six RSEs and the path dependency of incumbents, we see primarily incremental innovations from the regime. Incremental innovations build up over time to become major changes, and should not be regarded as less important in that regard (Betz, 2003, p. 73; Rosenberg, 1982, p. 62). However, incremental innovations rarely upset markets and initiate regime transitions, in opposition to 'disruptive' or 'path-breaking' innovations. Since path-breaking innovations are not supported by the RSEs, they are in need of finding a 'protected space', or a niche, where they can develop and grow. Not until they have been used, tested and refined and have managed to build up a supportive socio-technical structure in this space are they ready to take on the strong and hostile RSEs (Raven, 2007; Rip & Kemp, 1998).

2.4 The Niche Level

The lowest level of MLP is the protected space called a socio-technical niche where path-breaking innovations form and develop. Niches are still socio-technical configurations, but smaller and of more loose and unstable character than the regimes, often with initial low performance. Niches should be conceptualized as *cells for incubation* of technological innovations, and not solely as disruptive technologies in their own regard (Geels, 2002; Geels & Schot, 2007; Kemp et al., 1998; Rip & Kemp, 1998).

These incubation cells are protected from the mainstream market in different ways and do not compete directly with the dominant technologies. Protection can come from both naturally

occurring, *passive* shielding environments or from deliberate and strategic creation of a protective shield or market, called *active* shielding (Kemp et al., 1998). Beyond 'shielding', there are two other processes that play out at the niche-level: 'nurturing' and 'empowerment' (Smith & Raven, 2012). While the shielding is necessary to create the protective space that is the niche, nurturing is the process that makes the path-breaking innovation improve and grow. It is the very reason for which the shield is set in place; *"the processes that support the development of the path-breaking innovation"* (Ibid. p. 1027). Empowerment is the process by which niche innovations are made to leave the protected space and become competitive with dominant technologies. It is the building and negotiating of relations to the regime and the institutional environment.

2.4.1 Empowerment Patterns

The empowerment process can be achieved in two ways; by forming the path-breaking innovation and its relations to fit and become competitive *within unchanged, conventional RSEs.* This pattern is called *fit-and-conform* empowerment (here: 'fit-pattern'). The other alternative is instead to *negotiate changes* in the RSEs so as to favour the niche innovation. This empowerment pattern is called *stretch-and-transform* empowerment (here: 'stretch-pattern') (Smith & Raven, 2012).

Intuitively, this means that niche innovations that are empowered through a fit-pattern are less revolutionary for the socio-technical regime in general. It might constitute a low-friction substitution of a technology without the need to alter cultural or regulatory institutions. Locally this can have large effects, with some incumbents becoming disrupted, but the total regime structure is not altered significantly (Ibid.).

A stretch-pattern however, means undermining established regime structures, changing and interpreting landscape trends in a way that puts pressure on the regime and introduce niche institutions as new norms. This changes the global regime structure and is more noticeable for all actors in a regime. Such changes can be expected to lead to further reorientation before a new regime structure is established and can hence be expected to involve more friction and turbulence. Niche actors needs to be able to present solutions and ready alternatives to these problems to gain support. Due to the wider scope of stretch-patterns, the process will rely upon other processes of change within the regime and in the broader society and economy (Ibid.).

2.5 Multi-Level Interactions and Transition Pathways

The three layers in MLP constantly interact and co-evolve and under certain conditions pressure on

the regime can build up and it can go through transition-phases. In this way, socio-technical systems are *"characterized by tension between stability and change"* (Konefal, 2015, p. 614).

The main dynamics can be described like this: Regimes are stabilizing constellations that are path dependent. At the niche level, novel innovations develop and can gain momentum and become disruptive alternatives to the locked-in regimes. Developments and events at the landscape level lead to pressures on the regime level. This can lead to new directions of development for regimes and niches or even forcing adaptation, restructuring or causing regime collapse. Destabilization at the regime level opens up windows of opportunities for niches to enter and transform the regime (Geels & Schot, 2007).

The classical view of regime transitions was that a transition consisted of four successive phases; (1) pre-development, where radical innovations develop in a niche; (2) take-off, where the innovation finds a small market in which it can compete*;* (3) breakthrough, where the new innovation starts to compete with existing alternative at regime level on a mass-market; and (4) substitution and stabilisation of a new socio-technical regime (Rotmans, et al., 2001, p. 17).

A critique is that this represents a 'bottom-up' bias (Berkhout et al., 2004) and tends to *"emphasise processes of regime change which begin within niches and work up, at the expense of those which directly address the various dimensions of the socio-technical regime or those which operate 'downwards' from general features of the socio-technical landscape"* (Ibid. p. 19).

Geels & Schot (2007) aim to overcome this bias and identify four types of transitions, or 'transition pathways', to show alternatives to the 'bottom-up' pathway. To do this they specify factors that determine the form and direction of a transition: 'the timing' and 'the nature' of the interactions. When it comes to *timing*, a simple understanding is that landscape pressures might either destabilize the regime when the niche is *not yet developed* or when it *is developed*. When it comes to the *nature* of the interactions, the niche technology might either be 'symbiotic', i.e. can be adopted as competence enhancing add-on to the regime, or 'disruptive', i.e. a competence-destroying innovation that is not aligned with the regime and that represent an alternative socio-technical structure. In addition, the landscape developments might also be either 'stabilizing' or 'disruptive' in that they might either support regime structure or put pressure on regime structure. In reality there are most likely multiple landscape traits and niches relevant to a regime, making these highly aggregated and complex factors. Geels & Schot (2007, p. 404) also talks about different *kinds* of landscape developments, of which 'shocks' and 'disruptive change' are the ones they use most, and that are also relevant for this case. A schock is fast and have severe but specific impact, e.g. the financial crisis. A disruptive change also have sever impact, but only after long gradual increase, e.g. digitalization.

This thesis, just as Geels et al. (2016) and Geels & Schot (2007, p. 413, 'P5'), discusses how actions and responses to pressures can represent *shifts* between pathways. For such a discussion, and for understanding the pathways in general, a drawn model is a great help. It makes the *internal relationship* between the pathways visible and shifts can be described with a 'direction', up or down in the diagram. Shifts represents changes in the nature of relations ('P5' in Geels & Schot 2007, p. 413) and actors responses to pressures (Geels et al. 2016; Geels & Shot 2007, p. 414; Geels, 2005,

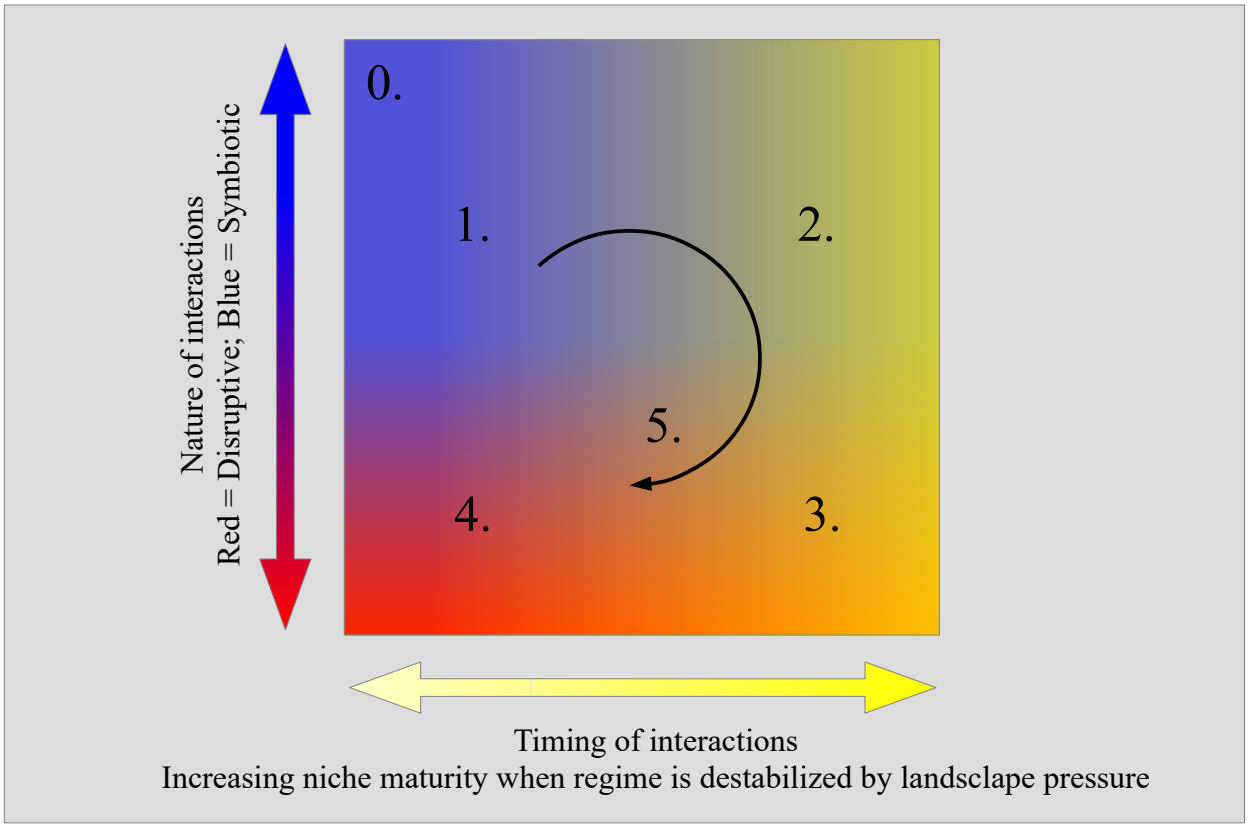

Figure 2. The tranformation pathway diagram.

are quite complex and *"narrative explanations do not work with dependent and independent variables, but explain in terms of patterns that result from interactions"* (Geel & Schot, 2007, p. 414). Figure 2 is therefore adapted from text, and it must be used with the previous statement in mind. The the nature of the axes and the graphical model is further discussed in chapter 6.

The four transition pathways are described as follows, numbered according to the structure suggested in my figure, not as in the text in Geels & Schot (2007). Descriptions applied from Geels, (2011, p. 32) and Geels et al. (2016, p . 898-900):

1. Transformation: A gradual reorientation of the existing regime through adjustments by incumbent actors in the context of slowly increasing landscape pressures and tightening institutions.

Incumbents reorient at different 'depth', gradually expanding their search activities in pursuit of solutions to the pressures. In extreme cases they can even change identity and business model and incorporate radical niche innovations, hence not necessarily remaining 'locked in' and doing incremental innovation as commonly assumed. This reorientation proceeds gradually. Its speed and degree depends on the strength of socio-political pressures and market opportunities. Niche innovations do not break through, but experiences from niches can be translated and accommodated in a watered-down form, in the regime.

2. Reconfiguration: Niche innovations and the regime combine to transform the system's architecture. This involves new alliances between incumbents and new entrants rather than overthrow. Typically, niche innovations are incorporated as 'add-ons', which subsequently leads to further changes and reconfigures the system. This fosters new knowledge, innovations, beliefs and goals that leads to unintended and open-ended consequences. The process is likely to start with limited institutional change followed by more substantial change that may involve struggles between actors.

3. Substitution: Tensions in the regime form a window of opportunity for the break-through of radical niche innovations that replace the regime. An alternative route is that niche innovations gain high internal momentum and replace the regime without the help of landscape pressures. Innovations with better price/performance characteristics will follow a 'fit-and-conform' pattern with limited institutional change. But rules and institutions can also be adjusted and created to suite the niche innovation, following a 'stretch-and-transform' pattern.

4. De-alignment and re-alignment: In this pathway, major landscape pressures coming as shocks first cause disintegration of regimes (de-alignment). Then, taking advantage of this 'space', multiple niche innovations emerge, which co-exist for extended periods (creating uncertainty about which one will become the winner). Processes of re-alignment eventually occur around one innovation, leading to a new regime.

0. If there is no destabilizing landscape pressure and no mature, disruptive niches we have a stable regime, path 0, also drawn in figure 2 (Geels & Schot, 2007, p. 406). This should not be understood as a static situation. There is still competition and change at a lower level of agency, but these do not upset regime structures.

5. Geels & Schot (2007, p. 413) also describes how a shifting, disruptive landscape can make a sequence of pathways possible, even going through all the pathways, from 0 to 4, in turn.

Geels & Shot (2007, p. 414) also *"acknowledge that agency does not always come through strongly in* [their] *stylised case studies and figures."* Geels et al. (2016) address this by paying more

attention to agency and institutions and hence getting closer to the micro scale. They go from the original 'global', 'outside-in' perspective, to a 'local', 'inside-out' perspective on transition pathways. This means looking at how the pathways are enacted by the actors and how the process of institutional change actually plays out. In doing so they take several factors into account, like landscape changes, static landscape characteristics, how actors choose to act and react and how technologies and institutions develop and are co-created and recreated through these actions. This process is to be understood as struggles and co-evolution and *moves the focus from landscape pressures or niche disruption*, that might have enabled the transition in the first place, *towards the endogenous enactment*. This means that agents and their actions have significant influence on the situation and will hence be a factor to be reckoned with in determining which pathway a transition takes. Their *"aim is to develop alternative understandings of shifts between transition pathways, which depend less on external landscape pressure and more on shifting actor coalitions, struggles, and adjustments in formal rules and institutions"* (Ibid. p. 897) since *"the influence of landscape developments arguably depends not only on timing (compared to niche and regime developments), but also on interpretation and mobilization by actors. Furthermore, whether niche innovations are 'symbiotic' or 'disruptive' depends not only on technical characteristics, but also on how such innovations are configured and institutionally embedded"* (Ibid. p. 896-897).

Geels et al., (2016) further point out that the focus on enactment underscores a fluid understanding of STTs, i.e. that a transition can *shift between* pathways and that different pathways sometimes follow each other depending on how they are enacted and how struggles turn out. Even more relevant for this thesis, Geels et al. make important contributions to the empowerment pathways and how the incumbents effects the form and direction of a regime transition. We can also see their interpretation and implementation of fit- and stretch-patterns as different patterns in the substitution pathway, something discussed later in this thesis.

An alternative framework that also suggests four different types of transitions, or 'transition contexts', was developed by Berkhout et al. (2004) and Smith et al. (2005). The starting point here is that regimes continuously face selection pressures and should be seen as a constantly changing structure. Hence they have another view on the 'timing' factor. Instead, it is the incumbents ability to respond to pressures, the 'adaptive capacity' of the regime, that is central in this model. The articulation of pressures, and the degree to which responses are coordinated and based on resources available within the regime are the factors that defines the characteristics of regime change. If resources comes from outside the regime, change is be more radical than if it is based on resources from within the regime. Geels et al. (2016) can be seen as taking the 'transition pathways' of Geels

& Schot (2007) a step in this direction, with the focus on endogenous enactment and less attention to the timing and nature-factors.

3 Research Methods and Design

The aim of this chapter is to give insight into how this study was conducted and therefore has a more personal tone. The research design and the methods used for data collection and analysis is presented and justified. My potential biases as a researcher, methodological difficulties regarding validity and reliability and some limitations are critically discussed.

3.1 Case Study Research Design

As mentioned in Chapter Fel: Det gick inte att hitta referenskällan I use a snapshot case study to approach this research question. A case study seeks to *"engage with and report the complexity of social activity in order to represent the meanings that individual social actors bring to those settings and manufacture in them."* (Somekh & Lewin, 2005, p. 32) It does so by taking an example of a complex issue to examine it in depth and using multiple methods and data to do so. Due to focus on depth rather than coverage, the historical and social context is also relevant to building understanding. A case study is thus *"particular, descriptive, inductive and ultimately heuristic, it seeks to 'illuminate' the reader's understanding of an issue."* (Ibid.) Hence, there is a distinction between 'the subject' of the study, that is the case itself as a set of real life events and relations, and 'the object', the analytical or theoretical frame through which the case is viewed and that the case is made an example of. (Thomas, 2011; Wieviorka, 1992)

The subject of this study then, *the case itself*, is the ongoing dynamic interactions between organizations and institutions in the financial sector and the technologies and actors in the blockchain community, as set in a wider environment. These interactions are not limited to human interactions, but can for example be between technologies, organizations, institutions and policy. The object of the study, what this is *a case of*, is the development and empowerment of a (disruptive, digital) niche technology by different actor-groups, set in a multi-level context. The units of analysis are the actions and strategies employed by the actors, their narratives regarding the technologies and two strategically selected BCTs. I state this explicitly since determining the limitations of the object is a major epistemological issue in case studies, determining what the claim to knowledge actually is. (Somekh & Lewin, 2005)

Yin (2013 p. 47) has discussed the rationale for choosing different case study research designs. He points out that by finding a *'critical case'*, a single-case design can significantly contribute to knowledge and theory-building. Such a case fits the circumstances described in the theory, but challenges some of its propositions. It could either confirm, challenge or extend the

theory by suggesting alternative explanations that might be more relevant. This is the hope and rationale for choosing this case.

3.2 Methodological Approach

In general, MLP case studies do not have very stringent methodological tools. Geels (2011, p. 36) has expressed concerns that, although transition studies could probably benefit from the application of other methods, the MLP should not be *"reduced to a mechanical procedure by forcing it into a variance theory straitjacket."* And that *"the research of complex phenomena such as transitions cannot be reduced to the application of methodological procedures and will always contain elements of creative interpretation".* The reason for this is that process theories focuses on complex dynamics that may be at odds with assumptions required for standard regression techniques and conventional comparative methods. The preferred approach in most MLP studies, as in this one, is instead a case study. This gives the analyst a wider freedom, and responsibility, to explore possibly relevant factors and variables since procedures for collection and analysis of data are not routinised (Somekh & Lewin, 2005; Yin, 2013).

However, there still needs to be reliable methods for analysis and data gathering, albeit ones that give some level of interpretative flexibility in the data analysis. The research design and methods used are crucial in order to get a conclusive answer to the research question and to guarantee that it is firmly based on reliable data.

Elliott & Timulak (2005) provides such a framework with a generic approach to descriptive/interpretive qualitative research that *"emphasises common methodological practices rather than relatively minor differences"* (Elliott & Timulak, 2005, p. 148). It is influenced predominantly by grounded theory (Henwood & Pidgeon, 1992; Strauss & Corbin, 1990) and Consensual Qualitative Research (Hill, Thompson, & Williams, 1997). Also Braun & Clarke (2006) have been helpful in the analytical work with their *"inductive thematic analysis"*.

The result is a study designed as a single, snapshot case study using a diverse set of qualitative data. The analysis aims to be *descriptive* in the sense that it aims to describe what the actors are doing, the interactions and the process that take place. It is *interpretive* as this demands more than just a description of events. To describe a process or interaction there has to be heuristic interpretation and contextual framing of what is going on and not only a 'raw' description of states and events. The empirical material needs to be theorized to fit into the pre-set conceptual framework of the MLP, but still needs to be independent enough to lead to alternative theoretical concepts if necessary. In this way, the study is also *exploratory,* in the sense that it poses an open

question as to what is going on at this scale of the theory. It does not test a certain hypothesis or measure a phenomenon but sets out to explore these processes. So within an already given theoretical frame, I aim to explore a certain area at lower granularity. As mentioned in the introduction, I also adopt an 'inside ontology' to observe, understand and describe how the dynamics of niche-regime interaction is enacted rather than making normative management proposals (Smith & Raven 2012, p. 1026).

The fact that this is an ongoing snapshot case and not a historical observation also has some methodological implications. A historical approach will always have a certain degree of hindsight attached to it. Since the outcome is known, historians make an informed narrative of what steered the development in a certain direction, with a risk of neglecting some processes and struggles that actually went on at the time. In this case, such subconscious biases are avoided to some extent, when the analyser is forced to look at what is actually going on, now. The challenge lies in differentiating the hype from the real development, while still appreciating how the hype and expectations are a part of the explanation for actions, and in trying to understand the present without help from a known outcome. This means that the focus is pushed towards the micro-level and becomes actor and action based. It also poses a challenge for the analysis and I had to be aware and explicit of the role that hype and expectations have in the process.

3.3 Biases, Reliability, Validity and Limitations

The main challenge with this study was my limited knowledge about the case beforehand. I have no academic background within these areas and had to make a big effort to develop a fundamental understanding about both the financial sector and BCT.

The benefit with being an outsider is that I do not hold any ideological preferences when it comes to blockchains, a topic that is often ideologically loaded. Many in the blockchain-community are outspoken about their mistrust in 'the system' and dislike banks in particular and I should state that I share no such general opinions. Such data play on ideological values and emotional responses making it hard to remain completely unaffected, unbiased and neutral. To remain neutrality I used the strategy of continously asking myself to what extent I am open for alternative findings.

My Scandinavian background, a society with minimal corruption and well functioning banking services and trust in authorities, might either 'help me avoid emotional engagement in' or 'stop me from fully appreciating' the attractive features of blockchains, since it to a large extent solves problems with weak societal institutions.

Critical self-reflection has revealed that I have come to admire the innovation capacity and

engagement within the blockchain community. This is likely to have affected my neutrality at times. But my respect for banks has also increased for the same reason. They have proven to be more forward looking and innovative than anticipated. If it were not for their social responsibilities as a utility service provider, it seems that at least individual employees are thrilled by the idea of revolutionizing the banking system in many of the same ways as the blockchain enthusiasts.

Having pointed out these issues, the more pressing concerns for validity and reliability are probably more in methodological rather than personal biases. Dealing with highly abstract constructs and concepts and 'measuring' and evaluating how they interact based on quantitative data necessarily has its shortcomings, for both validity and reliability. A weakness with this thesis is the lack of distinct variables and indicators. However, none of the theoretical frameworks applied provides such indicators, nor has the reviewed literature on other MLP case studies given concrete suggestions. To mitigate this, I have aimed at making the concepts and how they are applied clear; provided and openly discussed quotations from the data to show how the data relates to the results. However there also is a risk for a sub-conscious bias towards data that proves an idea, so called patternicity (Shermer, 2008). The unlimited amount of data available, and the freedom to choose from it, reinforces this. If a framework, like MLP, suggests a certain kind of pattern, there is a risk that the researcher notices and presents only those data that support this pattern. Data that do not fit however, may be overlooked. Hence, the theory might become self-fulfilling. Triangulation has been used to mitigate this somewhat. The choice to divide the analysis into three parts, was also an attempt to deal with this concern. If each section showed similar results, the analysis would be more trustworthy.

Another matter is the fast moving pace of development and shifts in expectations, norms and technology. If the blockchain strategy a bank has this month differs significantly from that of the previous, even perfect methods will not suffice. For the theoretical discussion of a snapshot case study however, it is of lesser importance that reality has changed, so long as the snapshot gives a picture of how it was at the time.

This study does not have any difficult ethical complications. There has been no need for precautions and routines for handling personal, confidential information or other ethical concerns.

3.4 The Practical Process

This thesis was written between May and September 206 and this time-frame was the major limiting factor. The topic was based on personal and independent interest and no other stakeholders have been involved or taken into consideration.

I started out conducting a review of the theoretical literature in the field to develop a 'theoretical sensitivity' before collecting and analysing data (Elliott & Timulak, 2005). I then approached the case quite openly to get a picture of what was going on. After some reading I was convinced that the MLP-framework could be suitable for understanding the case and that the case could provide interesting contributions. I formulated the research questions by posing questions like; *"What do we know about the phenomenon? Why is it important to know more? What has influenced previous research findings (methodology, social context, researcher theory)? What do we want to make clearer by the new study?"* (Elliott & Timulak, 2005, p. 149)

3.4.1 Selecting and Collecting Data

The open-ended and exploratory research question without fixed variables, favoured the use of qualitative data (Elliott & Timulak, 2005). Case study research does not prescribe certain methods for data collection, but allows the use of whatever data judged appropriate (Elliott & Timulak, 2005; Somekh & Lewin, 2005). The actors in this case are spread all over the world; covering a broad spectre of actors with interviews was therefore not be possible. Also, too much reliance on interviews with key informants might have compromise validity and resulted in *"an overly empiricist analysis – locked into the 'here-and-now' of participants' perceptions".* (Somekh & Lewin, 2005, p. 3) Similarly, a complete reliance on documents removes the ability to ask questions and might not reveal more unofficial views. Based on this reasoning I used a mixed set of data sources. This also allowed for triangulation which can increase reliability. (Somekh & Lewin, 2005, pp. 50, 44; Yin, 2013) The aim was a balance between official and unofficial, written and spoken, enthusiastic and sceptical, general and specific; categories that I tried to vary in order to get a nuanced picture. The analytical and theoretical framework could then give further guidance as to what relations, concept-categories and kind of interactions that were relevant and what 'questions to pose to the data'.

Thanks to the openness of the blockchain community, it is easy to get insight into day-to-day blockchain development from a range of online sources. Related forums, blogs, conferences, papers and podcasts gave insight into everything from discussions over technical details and niche politics to the latest gossip. Most major banks involved in blockchain development have published extensive reports with research and their views on BCT. These have been key sources of data for the thesis. Several interviews with bank employees at management level have also been interviewed, three of them belonging to the R3 blockchain-consortium. Unfortunately, the data from such incumbents rarely goes into detail about their own projects, and their reports are also a form of

marketing, showing that the organization is up front with this technology. Luckily, the whitepaper on Corda, the key application in analysis 3, was published during the work with the analysis.

The data consists of the following six types: (1) Text: Documents, in the form of public reports, white papers, newspaper articles and blogs. Main documents here are 11 position reports from major banks and financial institutions, often written together with major consultancy firms. (2) Interviews: Four semi-structured interviews with high ranking employees with blockchain expertise from different big Norwegian banks, approximately 50 minutes each. One semi-/unstructured interview with a Norwegian blockchain enthusiast and entrepreneur, approximately 1.5 hours. (3) Video: Screening of approximately 10-15 hours of recorded presentations and panel discussions from recent blockchain conferences and meet-ups from around the globe available online. (4) Audio: Approximately 10-15 hours of recorded interviews with blockchain developers and entrepreneurs from blockchain related podcasts *Let's Talk Bitcoin* and *Bitcoin Knowledge* published 2015-2016. (5) Other text: Frequent visits to blockchain-related community forums such as reddit.com, bitcointalk.org, letstalkbitcoin.com (6) Observation: An informal visit to the conference 'Oslo Blockchain Day' and subsequent restaurant visit with blockchain and Fintech professionals, enthusiast and entrepreneurs.

Different strategies and criteria was used to select different data sources. Ideally, the sources should be major, or influential, actors in their group. The sources should talk about blockchains and finance in a way relevant for the analysis. The material should preferably not be marketing material or aimed at explaining blockchain for 'dummies'. Much of the material does contain elements of the latter but is still useful, albeit not as trustworthy or insightful.

Due to my Norwegian location, selection of respondents for interviews was affected by geographic limitations. Some of the reasoning in this thesis may differ slightly from one nation to another, but both the actor-groups I chose are working at an international level with their blockchain strategies and co-operations. Differences in strategies when it comes to confronting BCT are most likely larger between individual banks in a country than between banks of different countries of origins. Respondents also talked primarily about banks in general and not their specific projects and strategies. Based on this, my judgement is that the lack of geographical spread of interview respondents has little relevance for the analysis or results.

The selection of interview informants from incumbents was based on involvement and knowledge of BCT among people in the financial industry. In documents from the Banking Standardization Office in Norway (Sletbak, 2015; Sletbak, 2016) I found a list of the country's most knowledgeable people and relevant organizations. Using this list compiled someone with insight

and contacts in the sector, I could easily send out requests for participation in interviews. I also looked for people holding presentations at events and conferences and tried to use the 'snowball effect' by asking each respondent for other suggestions. These methods have mostly resulted in getting the same names but gave at least one more interview and one thesis on BCT. This indicates some degree of coverage of central people in the Norwegian financial-blockchain space.

Some actors found the topic too sensitive from a business or regulative perspective and declined. Unfortunately this was the case with the Norwegian Central Bank. They instead referred to their report '*Financial Infrastructure 2016*' which gave limited room for analysis, but I found useful data in a published speech (Nicolaisen, 2016). Other central banks, especially Bank of England, have given out extensive research documents and whitepapers that represent the position of central banks. A few potential respondents did not answer the interview requests. Since this research does not rely on having a representative selection of a certain population for statistical analysis, but rather, builds a diverse view of a number of actors and processes, these selection processes have been appropriate, as far as I can judge.

Since there is not much BCT development of significance going on in Norway, the majority of material from the blockchain-community was found online. I only did one interview in person with this actor-group but found many recorded interviews on podcasts. Other useful material also supplemented this. I tried to incorporate views of the more prominent and knowledgeable people in the blockchain space, not just anyone posting on forums. Sources such as Coindesk and Bitcoin Magazine cover all stories related to blockchain, both regarding incumbent actors and the blockchain-community, and have made finding relevant material much easier.

3.4.2 Conducting Interviews

Even though it should be stressed that the interviews only make up a minority of the data I used, this section describes how the interviews were conducted.

Holding interviews with key actors was a suitable method of gathering data that was directly associated with the questions I wanted answered and of eliciting the opinions of the people that are most involved. Interview material, as opposed to the strategic wordings of documents, also has the benefit of human interaction and allows the possibility of gathering more informal data and personal experiences about the inside culture. Since I combined document analysis with interviews in this study, I aimed at having quite loose and informal interviews to contrast them with official reports. Hence, semi-structured interviews were suitable, with open-ended questions that aimed at getting

the respondents to talk freely within the limits of the case and its context. As a result, the interviews I got were quite different structurally, but the content was fairly similar. Despite not giving away details about ongoing projects, the respondents contributed significantly with more general observations and insider views of the industry and could confirm observations I obtained from other sources. In the interviews were questions aimed at getting both factual information (Kvale, 2008, p. 71) and the opinions of the interview subjects (Ibid, p. 106).

Interviews where conducted face to face, apart from one telephone interview. All respondents were enthusiastic about the theme and recognised what could be interesting angles, making the interview process easy and the atmosphere relaxed. The interviews were all recorded with the consent of the respondents, except for one who declined due to possible sensitive information. Two respondents wanted to stay anonymous and hence I have refrained from using the names of any of the respondents since this is of less importance for the results. The interviews were partially transcribed verbatim. The reason for the partial transcription, roughly 60%, was that some parts of the interviews where uninteresting for coding, such as introductions, informative questions and repetitions.

The interview template is attached in Appendix 1.

3.4.3 Analysing the Data

As previously described, the analysis is split in three parts. Slightly different analytical techniques are used for each of these parts, but the main method is a coding process following the guidelines in Braun & Clarke (2006). They describe what they call 'inductive thematic analysis', a qualitative method for identifying, analysing, and reporting patterns (themes) across a data set (ibid.). Inductive coding is used for analysis 2, and for analyses 1 and 3, a combination of inductive methods and pre-set codes is used. This means that a number of codes are derived from theoretical concepts, while more codes were created inductively from the data. In the coding process, key phrases in the data were identified and then labelled with a descriptive 'code'. This process was done by interpreting, reformulating and merging closely related statements to shorter codes. To create themes, related codes were added together in a similar process (Braun & Clarke, 2006). The phrases were chosen according to appeared relevance for the research questions and the analysis-part. Each analysis will be described further in Chapter 5.

4 Blockchain Technology

This chapter goes into detail about how BCT works and how it relates to the financial sector. Two different BCTs are presented in more detail: Bitcoin and Corda. The reason for the detailed description here is to give a deeper understanding of *why* and *how* blockchain technology is disruptive and why different applications are designed as they are. It is possible to follow the analysis without this knowledge, but the chapter is necessary to understand what the actors shaping processes really involves and which elements of the technology that is being negotiated and 'struggled' over. Chapter 4.4 and 4.5 are most important for the readers who are just interested in the analysis.

4.1 Introduction to Payment Technology

Today, payments are made following much of the same principles that have been used for centuries. The balance in one customer's account is decreased with the same amount as the balance in the recipient's account is increased. Transactions move from the payer's bank to the recipient's bank via a central authority acting as a clearing bank, usually the central bank of the country. The technology used to communicate transactions and record the balances have recently changed from paper to electronic form. This has also enabled a more diverse set of methods for conducting transactions, such as credit/debit cards, Apple Pay, Vipps, PayPal accounts and so on. These still use the same payment system however. Recently, new payment schemes such as mobile money have also emerged, for example M-Pesa and Alipay, actually using a new payment system, i.e. the customers call-time accounts instead of bank accounts, but still using national currencies (Ali et al., 2014).

To establish trust in such payment systems, customers need to submit extensive personal information. Electronic payments have hence made the issue of privacy more acute, as the possibilities to trace money and collect information related to transactions increases. They also demand extensive infrastructure. Even if it looks like a transaction has gone through for the customer, it is actually temporarily guaranteed by middlemen, while the real settlement takes place in back-office processes later on. To cover positions if something goes wrong, a lot of liquidities must be set aside until a transaction is settled (Adriano & Monroe, 2016). To keep account of all this, all parties maintain their own ledger systems, which means that there is huge duplication of effort and cost (Allison, 2016).

The latest developments in payments technology are the blockchain based cryptocurrencies,

that totally bypass the established payment systems. They feature both new decentralised payment systems and new currencies and therefore a fundamental change in how payment systems work. Blockchains are not only cryptocurrencies; uses in the financial sector are as diverse as trading infrastructure (for money transactions, shares, bonds or other tokenized assets), providing of digital identity and also securing and executing 'smart contracts' (Ali et al., 2014).

4.2 Short and Explosive History

Although the history of blockchains dates back to late 2008 when Bitcoin was made public by the pseudonym Satoshi Nakamoto (2008), their potential, beyond building cryptocurrencies, seems to have been taken seriously by most industry actors only since 2014-2015. When the theme made the front page of the Economist in October 2015 (The Economist, 2015), the hype really took off. For many actors blockchains still seems to be a mysterious phenomenon. They are at a stage where they are grasping for knowledge and information about what this technology might hold for them and for society at large. At present it is impossible to know the real potential of BCT, but there is consensus that there are a range of possible, often disruptive, uses extensible to a wide variety of situations. An online open brainstorm of possible use-cases contained 84 suggestions, covering everything from managing bonds to passports and nuclear launch codes (Ledra Capital, 2014). Concrete use-cases are now taking shape and real-world applications are beginning to launch and many more are in test-phases and under development.

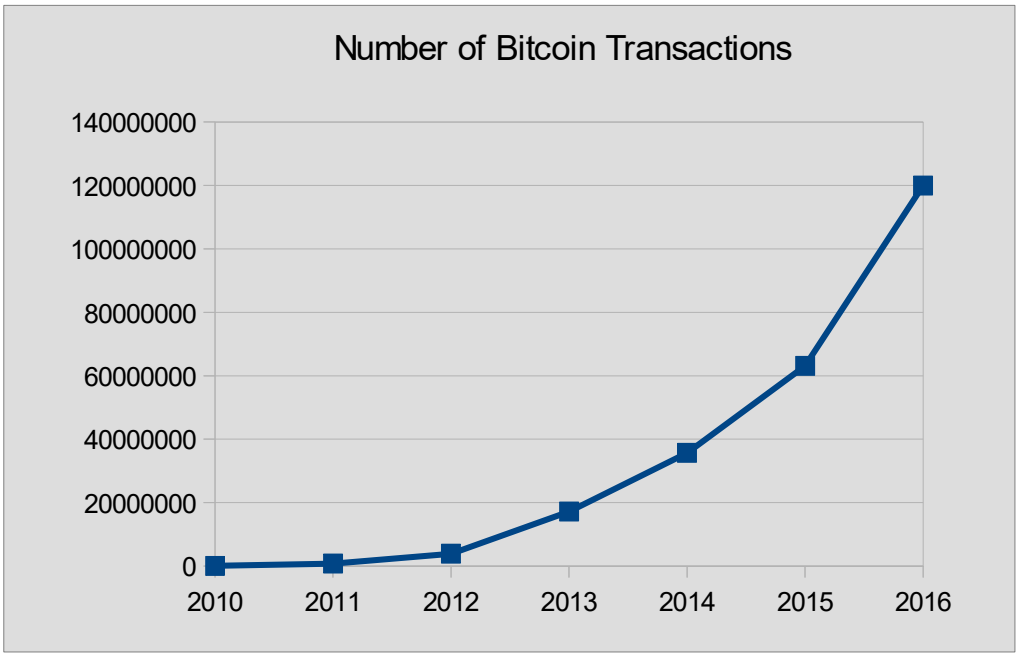

Figure 3. Number of Bitcoin Transactions. Source: Blockchain.info

The Bitcoin community is the main proof that the technology works, even if the currency has had a volatile history. Despite being declared dead by media 111 times as of September 2016 (99 Bitcoins, 2016), Bitcoin is still healthy and growing, both in number of registered wallets and also in daily transactions, as figure 3 shows. Although not used in daily activity to any big extent, several thousand businesses worldwide currently accept bitcoins as a form of payment (Ali et al., 2014). However, mass adoption of bitcoin as a means of payment is still far off and remains a dream for idealistic Bitcoin enthusiasts. Much more established is the use of bitcoins as a new asset-class for investment and value storage and transfer.

4.3 The Architecture of Bitcoin and the Invention of the Blockchain

The first blockchain was created to run Bitcoin. The design goal with Bitcoin was to create "*a peer-to-peer version of electronic cash"* that would "*allow online payments to be sent directly from one party to another without going through a financial institution"* and still prevent double spending. (Nakamoto, 2008, p. 1)

To achieve this, there had to be mechanisms for creating consensus about who owned what, for making sure that nobody could create new bitcoins at will, for controlling inflation and the issuing of new coins, for stopping double spending and so on. The solution was to have a massively distributed ledger in a network of users where mechanisms for control could run.

For payments to be recorded to the ledger they are broadcasted out to the network and spread like *'gossip'*. Some users, so called *'miners'*, take on the role of verifying and settling the transactions and thereby create the blocks that the blockchain is made up of. Blocks can be thought of as pages in the ledger. The ledger can then be used by anyone to explore any transaction, old or new, made between any bitcoin addresses on the network. Due to this transparency, bitcoin addresses are anonymous to protect the privacy of the user. Hence you cannot see who bought what from whom, but just that a certain amount was sent from one anonymous address to another (CoinDesk, 2014b)

To ensure that we get identical blocks/ledgers for all users Bitcoin uses a *consensus mechanism* based on a combination of cryptographic *'proof-of-work'* and market mechanisms. The miners compete to be the first to find a valid *'hash',* a cryptographic code, for each new block. A hash is created by running an algorithm over any amount of data, which then works out a unique code based on the content. The data in this case is all transactions done since the last block, the previous block-hash and a random number found by the miner. The random number is the only variable that is not fixed and must be such that the resulting hash meets certain criteria, making the

process of finding it hard, costing a lot of computation power and electricity. The first miner to find a legit hash gets a reward in the blockchains own currency, for Bitcoin: 12.5 bitcoins. The miner then distributes the block to all other users who validate it and add it to their blockchains. This is now the last valid block and the miners start working on finding the hash for the next block. The reward for mining halves every fourth year until 21 million bitcoins are produced. After this point, no more coins will be issued. (Nakamoto 2008; CoinDesk, 2014; Nielsen, 2013)

All the expensive proof-of-work computations serves the purpose of making the blockchain secure. A malicious attacker who tries to change a transaction in the chain would have to create an alternative 'history', a *fork* on the chain, containing the false transaction. He would then have to re-do all the work since the manipulated transaction faster than all other miners who keep adding blocks to the original chain at the same time. Catching up means using more computer power and electricity and than all other miners combined, a so called *51%-attack.* The longest chain hence serves as proof of the sequence of events since it comes from the largest pool of computer power (Nakamoto, 2008). In this way, the same mechanism is used for creating security, issuing the currency, incentivizing involvement and controlling inflation. This also means that if somebody manages to get a majority of computer power, he would also earn most of the new coins and therefore be incentivized to keep the network healthy, since this will affect the value of the currency he earns. This could in fact turn an attacker into a warden of the network (Antonoupolous, 2014).

This immutability means that the blockchain 'time-stamps' transactions by hashing them into the current block in the growing chain. Any user can go back and find their transaction and prove to others that it was included in a certain block that was mined at a certain time. A user who wants to prove the legitimacy of a document, or any data file, can hash it and send the hashed code as a transaction on the blockchain. It can then be proven that the document existed, with that exact content, at the time the block was mined. This is a notary service that could be used for securing and proving the legitimacy of documents like patents, contracts or diplomas.

Most blockchains also allow users to add some metadata to a transaction, creating the opportunity to use them as tokens for other assets, physical or digital. This simple function, together with the time-stamping gives even more applications, such as creating voting systems, ownership certifications for physical assets, issuing tickets, coupons, reward points, shares and so on. The blockchain can then be used as an infrastructure that guarantees security and transparency for trade of other assets (Bitcoin.it, 2016).

4.4 Defining Blockchain and Distributed Ledger Technology

A definition of blockchain technology might look something like this: a technology that strives to achieve immutable and trust-free databases through cryptographically hashing data into successive blocks where each consecutive block contains a hash of the previous block. Many would also include in the definition that the database is shared and replicated, that there is a built in incentive for users to contribute to a security mechanism, that block-hashes are published to the network to provide witnesses at each step and that the blocks are produced at a steady rate providing a time-stamp functionality. Some would also include that this is done on a *publicly open* peer-to-peer network (Hudson, 2016; Nakamoto, 2008).

Since a blockchain is just one of many possible data structures that provide distributed consensus, DLT is a wider term than BCT. Blockchains are the only distributed ledgers known to work for *public* networks in which anyone is allowed to participate *as a peer*. A distributed ledger then is a technology that ensures consensus in a shared, replicated ledger among multiple users.

As these technologies develop and new innovations are made, other suggestions to define or describe them are needed. In the definitions above, the term 'database' is used. The data in this database can in fact also be code with functions that users can utilize, so called ‘smart contracts’, something the definition above does not really make explicit. The inventor of Ethereum, a blockchain specialized in running smart contracts, instead gives this description:

“*A blockchain is a magic computer that anyone can upload programs to and leave the programs to self-execute, where the current and all previous states of every program are always publically visible, and which carries a very strong cryptoeconomically secured guarantee that programs running on the chain will continue to execute in exactly the way that the blockchain protocol specifies.(...) A blockchain is in this sense a new species of rule-system for economic coordination: so, alongside firms, markets, clubs, commons, and governments we now also have blockchains.”* (Buterin, 2015)

4.5 Different Blockchain Designs

Depending on the design of the technology and how it interacts with the network, a blockchain can balance different properties depending on what one wants to accomplish, such as immutability, trust-freeness, transparency, openness for use, privacy of data, anonymity, speed/latency (block time), capacity (block size), transaction content diversity (from one-dimensional value only to

executable code), energy efficiency, tokenisation and inflation rate. Some of these properties come together, some are interdependent while others are hard to combine. A blockchain designed for executing smart contracts, like Ethereum, does not need the same properties as a blockchain designed to run a global currency, like Bitcoin. However, a blockchain is a platform or infrastructure on top of which many different applications can run. The architecture of the blockchain and how it has combined its features will make it more or less suitable for different applications.

A blockchain can be *public*, i.e. open read/write for everyone, like Bitcoin, or *private*, i.e. only accessible to a closed group. It can also be *permissionless*, where all participants are equal peers, or *permissioned*, meaning that some have administrative or other sanctioned roles that can assert some power over the system, like being allowed to process transactions, mine blocks, freeze funds or accounts and blacklist users (BitFury Group, 2015; Swan, 2015). There is some confusion on these terms however and both public and permissionless are often used as a proxy for being *both* public and permissionless, since they often come together.

On the *public* side we find the main open source projects, Bitcoin and Ethereum being the biggest, with extensive, active online communities of enthusiasts. It is these that are framed as the disruptive technologies that could make banks obsolete. Their open structure calls for anonymous accounts and the use of a native asset, like bitcoins, and they are 'immutable' and censorship resistant by nature, meaning that there can not really be a regulator in control over the system. These traits are not really suitable for banks who are heavily regulated and need to be able to identify account owners, freeze or reverse funds or in other ways manage the system. Financial institutions are instead drawn to private solutions, making compliance with 'Know Your Customer' and 'Anti-Money Laundering' regulation easier (Deloitte, 2015; Swift, 2016).

There has been a lot of heated debate about whether or not the censorship resistant solutions are suitable for the financial market or not and whether regulated business can build upon unregulated infrastructure that is deliberately avoiding ties to jurisdiction . However, it is possible to design and implement permissioned applications on top of existing permissionless blockchains. Nasdaq's Linq project is an example of a heavily regulated regime actor using the permissionless Bitcoin blockchain to run its application. Linq is "*a platform for managing company shares (...) usually a labour-intensive, paper-based, manual process involving paper stock certificates, option grants and convertible notes that quickly become outdated."* (Shin, 2015)

If we look at table 1 below we see that private solutions are outperforming the public

solutions in many categories. The reason for this is that they rely on external mechanisms for security enforcement and trust building, while public blockchains solve all these issues internally and are hence autonomous. This is also the power of public blockchains. They are censorship resistant. Once initiated, they exist as long as users keep them alive. And due to their distributed nature without owner and with independence from juridical regulation to function, they 'float above jurisdictions' in a sense. But perhaps even more important is the fact that they are public open source projects and as such foster permissionless innovation (Brown, 2015a). As whole ecosystems grow around these platforms, it is hard to see how a private blockchain could keep pace with development even if it initially seems to have the upper hand on traits such as speed and energy efficiency.

	Public-permissionless	**Private-permissioned**
Access	Open read/write access to database	Regulated read and/or write to database
Speed/Capacity	Slower	Faster
Security	Proof-of-Work, Proof-of-Stake, internally secure architecture	Pre-approved customers, external reliance on law enforcement
Energy use	High (for Proof-of-Work)	Low
Identity	Anonymous/pseudonymous	Known identities
Asset	Native currency, tokens	Any asset
Reversibility	Framed as immutable, but reversible through forks if supported by majority of the community	Reversible according to set internal standards
Spam	Needs fee or other spam control	No spam, can exclude users

Table 1. Public vs. Private BCT. Source: CoinDesk (2016)

4.6 Corda

One of the major projects on the private-permissioned side is Corda. It is built by R3, or R3cev, an alliance of more than 55 financial institutions, as of september 2016, including some of the world's biggest banks, with a mission to realise the benefits of DLT. Apart from building Corda, they also run many test projects on Ethereum, but probably mostly to learn. They are also engaged in Hyperledger, another major project ran by the Linux foundation and backed by many major players.

Whereas Bitcoin and other cryptocurrencies to a big extent seek to create independent financial systems, DLTs such as Corda are aimed at reducing settlement times and enhancing

security in existing financial environments. They hence have another business problem to solve and different frames to take into account. Corda is a private, permissioned BCT/DLT while Bitcoin is a public, permissionless BCT.

Brown (2016), CTO of R3, explains Corda like this: *"Now imagine we had a system for recording and managing financial agreements that was shared across firms, that recorded the agreement consistently and identically, that was visible to the appropriate regulators (...) and which didn't leak confidential information to third parties. A system where one firm could look at its set of agreements with a counterpart and know for sure that: 'What I see is what you see and we both know that we see the same thing and we both know that this is what has been reported to the regulator'. That's Corda"*

"It is a distributed ledger platform designed from the ground up to record, manage and synchronise financial agreements between regulated financial institutions. It is heavily inspired by and captures the benefits of blockchain systems, without the design choices that make blockchains inappropriate for many banking scenarios" (...) "trying to strike a balance between the open nature of blockchain, (...) and banks' desire to shield confidential details from competitors".

There has been some discussion on whether Corda is a BCT. In fact, Brown prefers to call it a DLT and not a BCT, since the blockchain is only a part of its architecture and because it differs a lot from what is usually meant with 'BCT', i.e. public designs like Bitcoin.

5 Analysis

After first presenting the analytical framework and defining the case in terms of theoretical concepts, each of the three stages of the analysis are presented and eventually summarized.

5.1 Analytical framework

Now that the theory, methods and context of the study is presented, it is time to engage the theories and provide a framework for an analysis of the case that can help in answering the research question.

The MLP provides us with three heuristic levels of aggregation and the conceptual understanding of the dynamics between them. The relationship between *niche, regime* and the *external landscape* first needs to be identified in the case to provide a context for the rest of the analysis. According to Geels & Schot (2007), the *nature* and *timing* of these interactions can also be used to differentiate between different transition pathways. This is a concept that describes the trajectory of the regime and the niche innovation, which would be relevant for this study. Examining these factors and using the transition pathways as a framework would therefore help in understanding how actions at lower level affects regime and technology development.

Geels et al. (2016) show that also the endogenous enactment is relevant for how transition pathways play out. The actors' struggles over technology deployment and socio-technical negotiations add up to form trajectories for niche innovations and regimes. This case lets us focus on a young but rapidly developing niche innovation with rather general purpose (Lipsey et a., 2005) that has also been understood as disruptive in this initial phase. The niche sees engagement from both incumbents and more loosely organized niche actors. These actor-groups have different interests and resources and aim to shape the technology for different purposes. The case can therefore illustrate how a technology of this kind is made relevant for the regime in different ways, by different actors. The *empowerment patterns* described by Smith & Raven (2012) provide a framework for identifying, analysing and understanding such processes. (The term 'pattern' is used here to avoid confusion with 'pathways', which describes different kinds of transitions at the regime-level.) Showing how the actor-groups employ *stretch-* and *fit-patterns* is a way to show how actions and events, technological configurations and narratives are connected to the bigger picture of long term trajectories. To do this, the fit- and stretch-patterns should ideally also be connected to the empowerment pathways and the factors determining them. Establishing a relationship between the

empowerment patterns and the two factors determining the transition pathways is a theory development that the case could contribute to. Based on theoretical reasoning, there seems to be a close connection between the '*nature of interaction'* between niche and regime (which can be either 'symbiotic' or 'disruptive' and determines the transition pathway) and whether a niche becomes competitive either within unchanged RSEs (fit-pattern) or by making changes to the RSEs to favour the niche (stretch-pattern). This is only *one* case study however, with very limited resources, and the findings here can not be generalized into theory. However, it can provide a basis for discussion and a first step towards such an integration. The primary goal is not as ambitious, but is focused on how the actor-groups in this case can be said to empower BCT, following the fit- and stretch-patterns. Analysis 2 and 3 are aimed at establishing this connection, in the light of the first 'global' analysis.

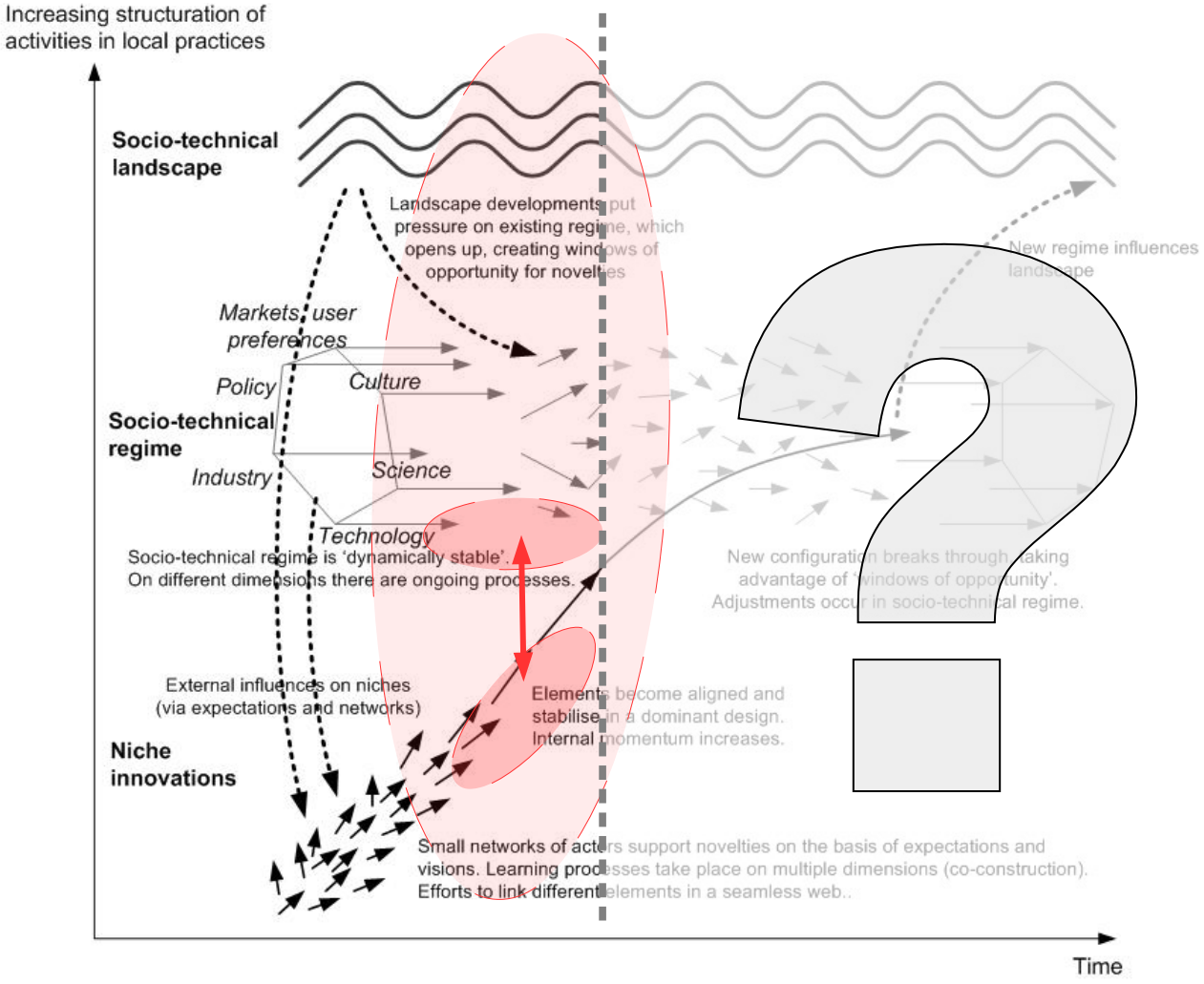

Figure 4: Analysis Map Set Within MLP Framework. Adapted from: Geels and Schout (2007, p. 401)
Red ellipses and arrows shows where in the MLP framework the study is situated. The large ellipse represents analysis 1, while analysis 2 and 3 are situated within the smaller ellipses. The dividing, grey line symbolizes the present.

The fit- and stretch-patterns have already been described (cf. 2.4.1). However, to identify them in the empirical data we need to know more about what we are looking for. Smith & Raven (2012) distinguish the empowerment process from the nurturing of a niche innovation. I argue that also the nurturing will have a certain direction that is already closely related to the empowerment pattern, making them hard to separate. To achieve empowerment and competitiveness for the niche innovation, it must be improved and developed, i.e. 'nurtured', following some *criteria* of success, set by the *agenda* of the involved actors. A technology is 'successful' only if it helps achieving the goals of the actor. In this case, making Bitcoin even more censorship resistant is hardly an improvement seen from a regulators perspective. This means that the nurturing also has a certain *direction*, and depending on that direction, either a fit- or a stretch-pattern would be a suitable strategy. A good way to approach nurturing and empowerment patterns is therefore to look at them together, as 'niche *development* patterns'. This is how they should be understood in this analysis. And that the *fit-and-conform* and the *stretch-and-transform patterns* are the two alternative end-points on a scale. Viewing this as a scale means that a niche that is mainly on a stretch-pattern will use some fit-pattern arguments and negotiations. A niche technology might for example *fit* one RSE but *stretch* another, or might both use fit- and stretch-narratives depending on audience and situation.

This also means that how a niche technology is designed and the design goals of the actor behind it, can say something about the empowerment pattern employed. The third analysis is therefore focused on the technological level, comparing two strategically chosen and contrasting BCTs: Bitcoin and Corda. We have already seen that BCT is developed in two main directions; public and private, which combine the technological features in different ways. Corda and Bitcoin will serve as the main examples of these two directions and the actor-groups behind them. Bitcoin is by far the biggest public blockchain, developed by niche actors, largely for ideological reasons. Corda on the other hand is the main inter-organizational technology developed by financial institutions in the R3-consortium. In stark contrast with Bitcoin, the design goal is to maximize efficiency in the existing financial regime and comply with regulation. The choice is also based on their clear connection to the actor-groups and typical design. Other major blockchains, like Ethereum, and to a certain extent also Hyperledger, have seen much more mixed interest from both interest groups. Although information on how Corda will work is limited, Hyperledger is an a even earlier stage and Ethereum is a public blockchain. The data on Corda came from the Corda-whitepaper, the official R3-blog and through interviews with three representatives from banks that

are R3-members.

To find out if these technologies are designed to fit or stretch the regime, we need a more specified conceptualisation of the regime. The RSEs (cf. 2.3.1) provide such a framework, which enables an analysis that considers how each technology relates to one RSE at a time. The 'question asked to the data' is then: 'Do these design choices fit/reinforce current selection environment or do they need/suggest a changed/alternative selection environment to be competitive?'. The same qualitative data is used for this pre-coded content analysis. Since the technologies are still under development, the analysis considers, not only technical, but sucio-technical configurations. This includes visions and design goals as presented by sceptics and advocates. The aim is to find how two key BCTs relate to the regime in terms of: if and how they follow fit- or stretch-patterns and to what extent they can be said to be disruptive or symbiotic to the regime.

	Analysis 1			**Analysis 2**		**Analysis 3**	
	Niche	**Regime**	**Land-scape**	**Niche-narrative**	**Incumbents-narrative**	**Bitcoin**	**Corda**
	Interactions between levels					**RSEs**	**RSEs**
Stretch-pattern	(n/a)			Fit/Stretch	Fit/Stretch	Fit/Stretch	Fit/Stretch
Fit-pattern				Fit/Stretch	Fit/Stretch	Fit/Stretch	Fit/Stretch
Nature of interaction	Symbiotic/Disruptive			Symbiotic/ Disruptive	Symbiotic/ Disruptive	Symbiotic/ Disruptive	Symbiotic/ Disruptive
Timing of interaction	Landscape pressure/ Regime destabilization/ Niche maturity			Landscape pressure/ Regime destabilization/ Niche maturity		(n/a)	

Table 2. Overview of the analysis and the analytical framework.

5.1.1 Defining the Niche, the Regime and the Actor-Groups

The regime in this case is to be understood as the socio-technical constellation associated with the global financial sector with its institutions, techniques, rules, practices and networks of actors and technologies. The central actors 'maintaining' the regime can in one sense be all of us, as users of financial services and our habits when it comes to payments, loans, savings accounts, trust in authorities and security concerns. But in this thesis, the central actors, the 'firms-in-industry' (cf. Geels, 2013), most closely associated to the regime are the incumbents, as in big institutionalized financial institutions; like national, commercial, and investment banks, asset managers, brokers, stock exchanges and so on. Central regime configurations in this case are the accounting and settlement systems used to track and record assets within and between financial institutions. The

'financial regime' is therefore narrower than the 'socio-economic regime', but wider than the 'payments regime', since blockchain application goes beyond payments.

The central niche in this case is the socio-technical space surrounding BCT. The actors involved in this space, the 'niche actors' can be understood as the blockchain communities made up of users, enthusiasts, developers and startups. These are loosely arranged communities open for anyone to contribute to and engage in, both commercially by buying, selling and using the currencies, but also through open source code development. The companies in this space are mainly entrants, but also large, established companies, mainly from the IT sector, are getting involved in BCT. These large firms, like IBM and Microsoft, are hence not incumbents in the financial industry, but rather hopeful disruptors connected to the niche. However, there are many smaller startups involved with BCT that do *not* fall in the NA-group. Those are companies catering for and cooperating with enterprise customers in the financial sector and are regarded as connected to the financial institutions. Since the banks are no experts in BCT they hire a lot of consultancy and development expertise from the blockchain community. Much of the activities done by incumbents are in fact carried out by small, young companies in the blockchain industry. These are most likely made up of individuals who when speaking as private persons, could arguably count as niche actors. This stresses that the niche actors are a wildly heterogeneous group.

This division into two actor-groups, separating niche actors from the incumbents and simplifying a complex network of actors, is necessary for analytical purposes. It is potentially problematic since it is possible to argue that incumbents involved in developing a path-breaking innovation are therefore also 'niche-actors'. In addition, there are many companies in the BCT-niche that arguably share more values with regime incumbents than with blockchain 'activists'. This distinction can be seen as a limitation in the study. Niche-actors are understood as the communities (of people, organizations and entrant firms) who support path-breaking BCTs *other than* the ones developed by the incumbents. In analysis 3, this distinction is less complex since it is a comparison between two distinct BCT-solutions.

At the niche-level, there are several seemingly competitive BCT alternatives, each with their own supportive networks, within the limitations of this case. Between these there is also a mutual network and a lot of exchange and shared features. The whole BCT-niche can perhaps be likened with a hydra with many different heads stemming from the same body. It is also likely that there is more synergy than competition between different heads. Antonoupolous (2016, 30:00) suggests that the relative simplicity and robustness of Bitcoin and the flexibility of Ethereum probably works very well together rather than being competitive with each other, but this is hard to judge for

certain. Even if many users probably are the same people, some take a stand and are explicit about the other's weaknesses and online forums are full of hateful comments and backstabbing.

My interpretation is that there is one 'global' heterogeneous and diverse BCT-niche, with many sub-niches each centred around a specific blockchain.

5.2 Analysis 1: An MLP Overview of the Case

This analysis is a content analysis applying the basic MLP-framework as predefined codes to identify and analyse the interactions between the MLP-levels. The intention is to get an overview of the historical and relational processes in the case, especially regarding landscape features, since they play minor roles in the following analyses. This will indicate whether the 'requirements' for a transition are in place and explore the nature and timing of interactions that determine transition pathways (cf. 2.5). The aim is also to provide an explicit context for the following analyses.

5.2.1 Multi-Level Interactions

The most fundamental landscape development relevant for this case is the wide socio-technical trend of increasing digitization of all industry sectors, building on the rise of the Internet. In the wake of this landscape trend, many industries has been disrupted by a second wave in the form of game changing peer-to-peer solutions, e.g. Napster, Uber, AirBnB. This is yet to happen in finance at big scale but is certainly on the horizon with the 'Fintech revolution'. *"*[The Fintech trend] *is a logical and evolutionary step being driven by sector-overarching technological advance"* (Dapp 2015, p. 25). Interview respondents mentioned peer-to-peer lending, new payment services and crowdfunding platforms as services that are threatening the banks. There is therefore increasing pressure on the banks with new entrants, incumbents from other sectors and new technologies, at the same time. BCT is also born out of these trends and is strengthening them. It provide actors with new tools and ways of organizing that are aligned with the norms and institutions in this 'peer-to-peer paradigm'. This landscape change has many sides to it, from digitization to 'the sharing economy', and is defined as a *disruptive* landscape development (Geels & Schot, 2007, p. 404). It brings with it both cultural and technological knowledge factors that are necessary for BCT.

Another aspect of digitalization regards the privacy of information. As money goes digital, the surveillance and censorship of money becomes a major issue. As governments and private companies get more insight and power over such information, the response from the blockchain community is to find solutions that counteract this and keep assets private and uncensored, while

corporate interest lies in monetizing such information. Bitcoin, Monero and other cryptocurrencies are direct responses to such tensions.

Reitman, (2011) writes: *"one must first note that money in the digital age has moved from a largely anonymous system to one increasingly laden with tracking, control and regulatory overhead. (...) Bitcoin is particularly interesting in the wake of recent events that demonstrated how financial institutions can make political decisions in whom they service, showcased by the decisions of PayPal, Visa, Mastercard and Bank of America to cut off services to Wikileaks."*

Relevant in this regard to both regime stability and niche development is also the financial crisis of 2008-2009 working as a *specific shock* (Geels & Schot, 2007, p. 404). European banks have not made returns in excess of their cost of equity since the crisis, and are not expected to do so for years (Deloitte 2015, p. 2). However, it is not primarily the economic effects, but the *perceived failure* of the financial system and the *low levels of trust* in its institutions, that are important for this case. Such a trend gives incentives and interest for innovations that can provide solutions or alternatives. The blockchain is exactly that. In the very first block of the Bitcoin blockchain, Nakamoto included the hidden message: *"The Times, 03/Jan/2009, Chancellor on brink of second bailout of banks."* This refers to an article on the financial crisis and the failure of the regime, published the same day as Bitcoin was launched (Elliott & Duncan, 2009). Since many had tried to find similar solutions for years (Rose, 2015), the blockchain structure would probably have been figured out regardless, but the question is; if it wasn't for the financial crisis and the diving trust in banks, would it just have remained a forgotten experiment on the cypherpunk e-mail list, read by a few enthusiasts? As it was, this email (Nakamoto, 2009) instead started the rolling ball that is now a multi billion dollar industry. The mistrust in the regime after the crisis of 2008-2009 and the growth of Bitcoin at least correlates, as shown in figure 5.

The regulatory changes that followed the crisis and 'the was on terror', have been relevant for the blockchain sector (De Cremer, 2015; The Financial Brand, 2012). New regulations and compliance demands have made on-boarding and getting loans more difficult and frustrating for customers. At the same time, technology and telecom firms are entering the market, taking the low-hanging fruit from the bank's service supply. This leaves the banks in a tough spot. They are losing customers to new entrants in the financial market who provide fast and easy online services that are lightly regulated, while the more heavily regulated banks with complete financial services struggle to maintain service quality, as their technology is more centred on addressing risk, security and compliance needs and keeping legacy systems running (Raftery, 2016, interview respondent).

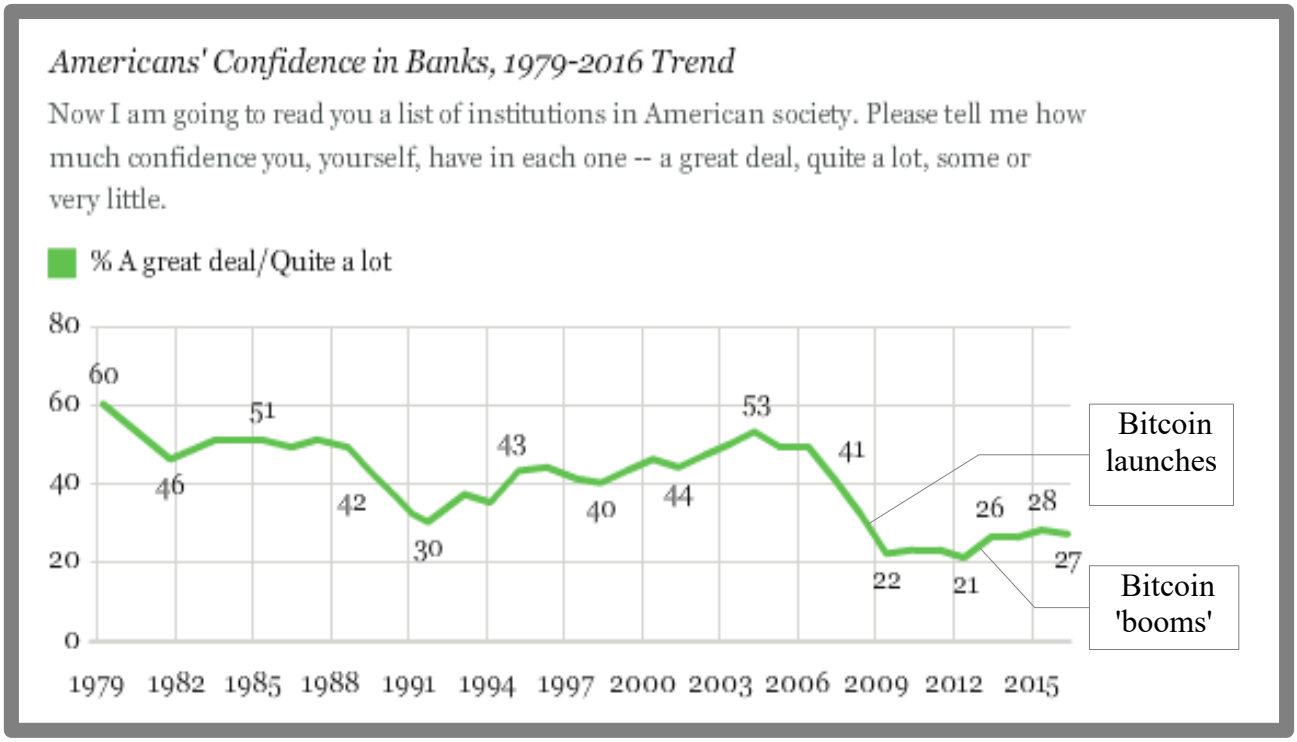

Figure 5. Trend for Trust in Banks and the Invention of Bitcoin. Source: Gallup (2016)

However, different landscape developments are important for different actors. For example, central banks have been active in research and development of blockchain based digital currencies. For them, the lack of market response to the extremely low, or even negative, nominal interest rates seen lately is a reason to look at new monetary regimes and new tools for monetary policy: *"[Central bank-issued Digital Currency] price or quantity rules, as a second monetary policy instrument, could substantially improve the central bank's ability to stabilise the business cycle"* (Barrdear & Kumhof, 2016, p. 2). This illustrates how different actors have their specific context that different landscape pressures leads them to adopt different niche innovations, or in this case, with a multi-purpose technology; shape them slightly differently.

Other landscape developments that are stimulating the blockchain niche globally are international labour movement, online trade and online labour, since they result in growing demand for fast and cheap international money transfers. Another relevant landscape feature is the widespread, general optimism around digital platforms as innovation hubs.

As Geels (2011, p. 36) points out, it is also important to consider the many *stabilizing* landscape features affecting the regime. The regime in this case is deeply rooted in society, with close bonds to policymakers, since it provides vital societal functions. Providing stability and avoiding risk in this regime is a major stabilizing landscape feature and a top priority from

governments and industry.

The banks are well aware of their intimate bonds to the socio-economic stability and over the centuries this has been built into the culture of the industry as a sense of security in being 'too big to fail'. This was put to test in the bailout of banks during the financial crisis. The banks feel rather confident that there will not be a total disruption of the banking or payment system from some idealistic and loosely organized community of crypto-anarchists. *"The regulators will never allow bitcoins to become a major form of payment!"* as one interview respondent put in.

Despite the historic stability of the financial regime, recent disruption in many other established regimes as a result of digitization, seems to have made industry actors vigilant. In addition, competition in the sector is harsh with concrete risk of being outpaced in the changing industry environment. It is critical for banks to be at the forefront of technological progress and to build capabilities for the future of the industry, and they see BCT as a critical technology in this regard. The interview respondents have stressed this point of *"being where the action is"*. Therefore the banks now rapidly build up their capabilities, experiment, build strategic co-operations and try to utilize BCT to be competitive in whatever is to come. Engagement in BCT has been a massive movement in the financial sector, with large investments, comparable to that of the Internet in the 1990's (CoinDesk, 2016). The engagement from the banks is mirrored in the shift in investments; from 'Bitcoin' projects to other 'blockchain' investments (figure 6). The biggest consortium of financial institutions, R3, has grown from 6 to about 60 members during the first year; Sept. 2015 to Sept. 2016 (Wikipedia, 2016). Noteworthy are four main development projects that, to a large extent represent the incumbents version of the niche innovation; Corda by R3, Ripple, Hyperledger hosted by the Linux Foundation and various digital currencies by central banks.

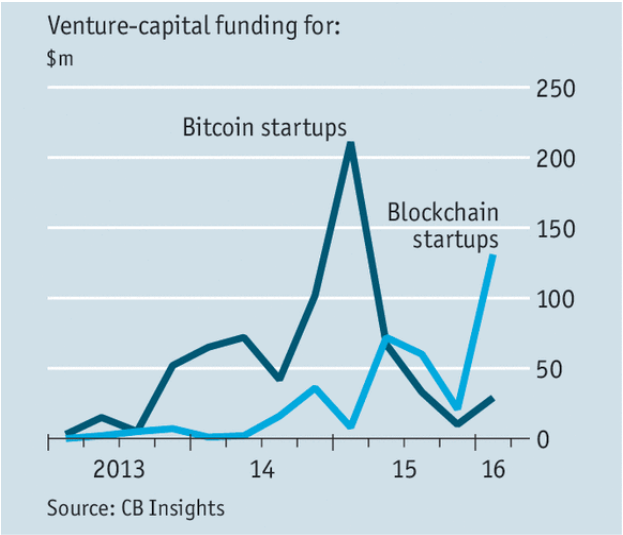

Figure 6. Venture-capital funding for Bitcoin specific and other Blockchain startups. Source: The Economist (2015)

These niche-activities often led by incumbents, represent a different path that deviates from the original Bitcoin niche. The incumbents are keen to stress this to avoid association with the controversial Bitcoin sub-niche. Brown (2015b) summed up the situation perfectly just before he became CTO for R3: *"the blockchain revolution is so fascinating because it could actually be TWO completely different revolutions… both profound in*

their implications: ¤ Censorship-resistant digital cash providing a new platform for open, permissionless innovation driven from the margins. ¤ And industry-level systems of record driving efficiencies for incumbents."

For Bitcoin, there have been specific market segments that have been niche-accumulating stepping stones and that have provided 'protective space' for the innovation where it has had time to be nurtured and improved (Smith & Raven, 2012). Bitcoin's censorship resistance and offered anonymity, the traits that repel the financial institutions, have instead catered well for illegal online trading and gambling sites, 'net-piracy' and for the open source movement in general. Even if the connections to illegal activity has been widely covered by media and given a bad reputation to Bitcoin, research has shown that this market-niche has outplayed its role in the last few years, showing maturity of the Bitcoin sub-niche (Tasca & Liu, 2016). Today, the main market-niches for Bitcoin are investment and speculation, international money transfers, storage of value when fiat currencies struggle with inflation and being a platform for other blockchain applications.

When it comes to developments that can open a window of opportunity for the Bitcoin-niche, it is most interesting to look at local or regional landscape developments. Such factors are runaway inflation, financial instability and widespread corruption that creates mistrust in central authorities and centralised systems in general. Also, more violent events that result in the collapse of social institutions would favour Bitcoin adoption. The economic turmoil in Latin America, especially in Venezuela, has led to such trends (Singh & Vega, 2016). Improved Internet infrastructure in African countries with high inflation and access to banking services are likely future candidates.

5.2.1.1 Summary of Analysis 1

An MLP-interpretation of this case, illustrated in figure 7, is that the current landscape conditions are such that there is disruptive pressure on the global financial regime, but also strong stabilizing factors. The regime saw some destabilization in the financial crisis and has not fully recovered, but is still far from collapse. Nevertheless there are arguably conditions for a transition. Locally or regionally, landscape developments can destabilize regimes and boost niche activity. In these cases, the Bitcoin niche stands out as the most mature alternative, with a clearly disruptive relationship to the regime. 'Digitalization', the major, albeit gradual, disruptive landscape pressure, has worked on the regime since before the niche existed. The combination of gradually increasing 'digitalization' pressure, the financial crisis and the maturing decentralization technologies in the niche that makes the situation for the regime unstable. It is clear that the regime has perceived and articulated the

pressures, which is a prerequisite for adaptation (Berkhout et al., 2004; Smith et al., 2005). It is also clear that incumbents are expanding their search activities (cf. 'transformation pathway') and engageing in reconfiguration of the niche innovation. The latest development is that the incumbents are developing their own niche-alternative(s) with the goal of making them *less* disruptive and perhaps even symbiotic. The following two analyses will look more into this.

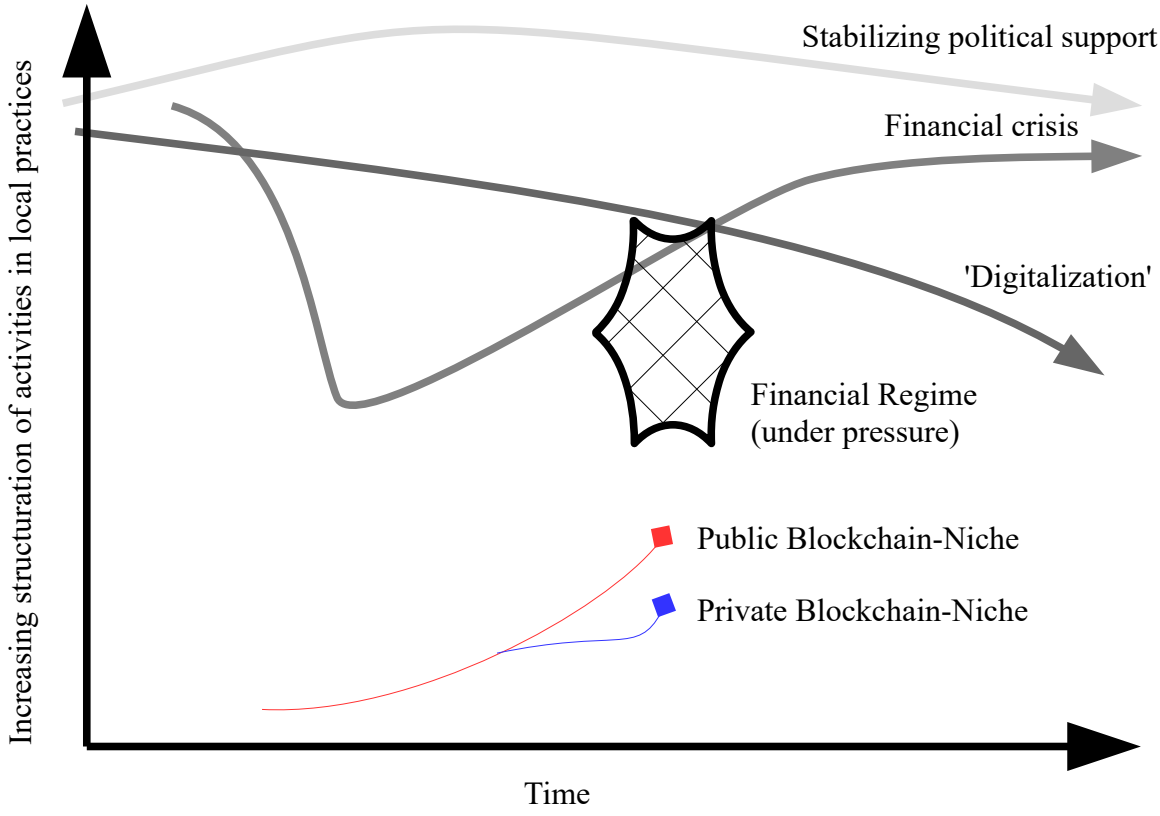

Figure 7. MLP-interpretation of the case. The figure summarizes the first analysis and schematically shows the most prominent landscape developments as well as the development of the blockchain niche and how it has recently split in two as a result of the division between private and public blockchains and the two distinctly different actor-groups that supports them.

5.3 Analysis 2: The Narratives of the Actor-Groups

The analysis is focused on the actors perceptions and arguments regarding the technology and its context. It is an inductive thematic analysis where the data was coded and then organized according to content into bigger themes to describe the *narratives* of the different actor-groups (Braun & Clarke, 2006; Elliott & Timulak, 2005). Smith & Raven (2012, p. 1031) identify narratives as being crucial in niche-politics as *"key political devices used by global actors to argue for (...) institutional reforms or claim present-day competitiveness within unchanged selection environments",* i.e. to argue for a *stretch-* or *fit-patterns*. They propose three characteristics that narratives show, different types of 'arguments' used by actors, that works to either stretch or fit the

regime:

"(a) positive expectations about the future that justify the niche to wider audiences; (b) explicit claims for present-day niche friendly institutional reforms (or claims of present-day competitiveness within unchained selection environments); and (c) statements that re-frame the past to challenge the prevailing regime in ways that emphasize future opportunities for the innovation (and statements that defend regimes)" and that *"whether niche actors are seeking [a stretch- or fit-pattern], this will entail different political narratives for different audiences"* (Ibid. p. 1034).

Accordingly, such narratives are key units for analysis when identifying and understanding empowerment patterns.

Not only niche actors use narratives as political devices. Incumbents also argue for their preferred trajectories. Here, he narrative of the 'incumbents' is compared to that of the 'blockchain community'.

The analysis also aims to map how the actors conceive the factors that determine the transition pathways. Although the factors determining the transition pathway are not directly influenced by the narratives, it matters how these factors are perceived and interpreted by the actors. This is the whole idea behind the 'insider ontology'/'inside-out perspective' argued for in Smith & Raven (2012) and Geels et al. (2016) and the reason the latter point out the importance of *"interpretation and mobilization by actors" (Ibid. p. 897).*

Only themes judged as relevant for the empowerment patterns and pathway enactment are included here. After presenting both narratives and the themes they include, illustrated by typical quotes from the data, the narratives are summarized and interpreted.

5.3.1 The Narrative of the Incumbents

Bitcoin is bad, blockchain is good

The narrative of the incumbents, since sometime in 2014, has been dominated by the theme *Bitcoin is bad, blockchain is good,* alternatively *Private before public.* What they are saying is basically two things. First that blockchains, or as is preferred by banks; distributed ledgers, holds great promises:

"[BCT/DLT] represents a once-in-a-generation opportunity to transform the economics of data management across the financial industry" (Brown, 2016).

Secondly, that Bitcoin, the most successful use-case so far, is *by design,* expensive, slow, has scalability issues, uses too much energy and is either illegal, anarchic or at least beyond where regulated industry can go. Or simply 'bad:

"Bitcoin and Ethereum intentionally lack any ties into the traditional legal infrastructure. (...) In other words, public blockchains are anarchic" (Swanson, 2016).

Due to its consensus model, based on transparency and sharing of data, it *"would never fly on Wall Street"* (Leising, 2016). The theme both builds expectations for the technology and specifies what shape this technology *must* take to be applicable to regulated industry. The theme also points out which shape is useless:

"[Bitcoins proof-of-work] model cannot, however, be translated to the financial industry: the cost would outweigh all the benefits. Hence alternative ways of securing the system must be examined, not to mention the scalability and latency issues." (…) *"The industry trend is to rely on a private and permissioned ledger whereby participant access is strictly controlled and reliant on alternative consensus algorithms to perform transaction validation"* (Swift, 2016, p. 2).

The theme stresses that BCT is much more than cryptocurrencies like Bitcoin. It is a re-framing of the technology and a shifting of focus, from Bitcoin to the underlying blockchain. Further that this technology can be shaped into something that is actually *useful* for the regime. Not only Bitcoin, but *public blockchains* in general are seen either as flawed and lawless or at least not the way to go for the financial institutions. A *private, permissioned DLT,* rather than *a public BCT*, is believed to better encompass efficiency and regulatory demands needed for the financial sector. This is a key statement for this thesis that can have fundamental consequences for the technological trajectory. By arguing that public BCT does not 'work' and by developing private permissioned alternatives that do, the incumbents can steer the trajectory of this disruptive innovation in a direction where *they are still in central control*. In other words, turn it into a *symbiotic technology* that follows a *fit-and-conform pattern.* The political edge, the disintermediation, of the technology must be removed, or at least not affect the most central regime actors. The envisaged private, permissioned blockchains still rely on institutionalized control-organs and centralization, but might remove lower level middle men and cut costs. They could also keep nationally divided market structures, institutions and currencies by dividing the networks under different national control organs. A public blockchain would work to oppose such structures.

However, following a fit-pattern and aiming for a symbiotic interaction, is not the same as a belief in minor changes:

"Our view is that blockchain's impact may eventually reshape market structure, product capabilities and the client experience, ultimately having a lasting influence on the global economic system" (JP Morgan & Oliver Wyman, 2016, p. 4).

Indeed this seems to act more as a part of a stretch-pattern, but one should note the word

'eventually' here, and the focus on price/performance characteristics rather than 'political' characteristics in the same report:

"Industry convergence on a desire for permissioned, rather than public, ledgers has opened the door for new, faster consensus algorithms..." (Idid. p. 5)

As is argued in this thesis, the private DLT solutions presented by the incumbents are designed to maintain the central position of the banks in the regime structure. They acknowledge that market structures 'may eventually be reshaped', but just as described in the 'transformation' and 'reconfiguration' pathways, such gradual change can be handled by incumbents.

Private DLT gives efficiency rather than disruption

This theme stresses the important aspect that the technology is perceived of as a cost saver and a technology that *improves efficiency* in the regime. That distributed ledgers in *specific forms* can make the industry more efficient and save a substantial amount of money:

"[DLT] *could reduce banks' infrastructure costs attributable to cross-border payments, securities trading and regulatory compliance by between $15-20 billion per annum by 2022"* (Santander InnoVentures et al., 2015, p. 15).

Without this theme there is a risk that the hype-building of the first theme rebounds on the incumbents by also boosting public blockchain activity. It hence counteracts the 'stretch-tendencies' that could be seen in the first theme and 'tames' the technology. The suggested blockchain solutions from the incumbents will probably be radical and transformative in relation to other innovations in the sector, but not relative to other niche alternatives, and they can still be framed as strengthening for the existing regime. The following quote can illustrate both themes presented so far and how they fit together:

"A fully permissionless system with no barriers to entry or exit for agents verifying transactions, like in existing digital currencies, would almost certainly involve the addition of prohibitive societal costs if the system is to attain a macro-economically significant scale, at least as it is currently designed. But intermediate options that adopted a distributed, but 'permissioned' architecture would, we contend, provide an improvement in the efficiency of settlement and serve to improve resiliency relative to the status quo, both of which would represent a reduction in costs to the real economy." (Barrdear & Kumhof, 2016, p. 6)

This clearly shows the belief that BCT can be shaped into symbiotic forms through a fit-pattern. Of course fears of disruption might exist without being expressed or admitted. The public perception of stability in the financial sector is also key to its stability. The IMF's quarterly

magazine features an extensive, bullish article on BCT that can be a good example of how the financial institutions balances the hype and expectations around blockchains with the notion of a resilient regime that is not threatened, but can utilize this new technology to its benefits. Under the subtitle *"Created to avoid banks, bitcoin's blockchain technology may end up helping them"* the authors write:

"Some are asking whether bitcoin and other blockchain applications could eventually undermine monetary policy and financial stability—but the consensus is that there is no immediate risk" (Adriano & Monroe, 2016).

BCT exposes friction and spurs innovation

By introducing a new decentralisation-paradigm and new ways of achieving consensus in a network, BCT gives rise to a lot of innovative ideas for financial services. *"Harnessing this innovation potential is deemed crucial for success in the sector"* according to one interview respondent. This pushes even further the image-shift that banks are currently undergoing, from stable marble monuments to agile, digital tech-firms.

"Traditional banks now have the opportunity to face up to the challenges of digital structural change in what is not only a defensive reaction, but also in such a way that they are also perceived as serious, innovative market players eager to take an active part in the remodelling of financial services. At this juncture, transforming into a banking ecosystem represents an effective strategic option" (Dapp, 2015, p. 26).

But perhaps as importantly, BCT exposes how slow and expensive the current regime technologies are in some regards, compared to blockchain solutions. Everyone in the sector has to admit that the current regime is slow, complex and expensive and that it needs to be improved. In other words, there is recognition and articulation of the selection pressures working on the regime. Without this, the conditions for systems innovation do not exist (Smith et al. 2005, p. 1508). We have already seen that private DLT solutions are perceived as offering ways to make such improvements. But even if such solutions end up being watered down and less radical DLTs, they are the outcome of a process where new technologies and new ways of thinking about system architecture are challenging the dominant perceptions of the established regime. In other words, it was a wake-up call for the banks. As the CEO at Kantox argues:

"All the hype surrounding Blockchain, all the VC money invested, all the startups created, and the fear that the financial industry could be disrupted by Blockchain technology (something I hardly believe), has forced banks to move and investigate what they can get from Blockchain"

(Gelis, 2016).

And *"even if Blockchain does not end up replacing the core current financial infrastructure, it may be a catalyst to rethink and re-engineer legacy systems that could work more efficiently"* (Citi GPS, 2016, p. 8).

However, there is an innovation dilemma here between the power of innovation and of the incumbents' preference for private DLTs. A *public, permissionless* blockchain also means *permissionless innovation*. A private, permissioned solution on the other hand will have less network effects and might not be the same platform for innovation. Just like the Internet outpaced all intra-nets, the network effects of open, permissionless blockchains would probably outpace any private platform. But this is a trait that the financial institutions cannot have with their private solutions. Quoting the CTO of R3 again:

"[Bitcoin is slow and expensive] So ignoring it is perfectly understandable. But it could also be a mistake. Because it turns out that censorship-resistance implies an even more interesting property: permissionless innovation" (Brown, 2015a).

The bringing of new perceptions can hence be seen as a minor stretch of regime environment that can 'reorient' the industry through renewed innovation in legacy systems, in a transformation pathway. Overall however, this theme does not make clear arguments for a *certain* empowerment pattern. However, it presents a very important issue for policymakers and industry alike and one that creates *"positive expectations about the future that justify the niche* [read private BCT]*"* (Smith & Raven 2012, p. 1033).

It also supports the idea of successful response to regime pressures from incumbents, both through articulation of selection pressures and new possibilities for incremental as well as radical innovation.

We don't know how to use BCT, but it is still early days and we are in it together

This theme sums up three less prevalent parts and is more focused on actions. First, as all interview respondents have pointed out, the banks are still not really sure *how* they will use BCT in market solutions, despite making many advancements. As one respondent simply stated: *"We don't know yet what we will use the technology for!"* I regard these statements as a bit too modest and they do not really corroborate with written and published data. The overall impression is that both the low hanging fruit in the financial industry, and also some higher hanging ones, are pretty well identified and researched. But it is still unclear *how* and *if* many of these R&D projects will result in

implemented and successful products. Therefore, my interpretation is that there is uncertainty about what solutions will be successful and in what form, and that there is some degree of frustration 'behind the scenes' that is not publicly communicated.

One source of confusion and frustration is that incumbent suggested blockchains often seems to end up being closer to current database-technology than to existing blockchains, making the real use of blockchains obscure. This is also why the term 'distributed ledgers' is more used by the incumbents rather than 'blockchains'. Another reason is that there are so many different use-cases and ideas under development that it is hard to say what will catch on.

The second part of the theme, 'it is still early days', points out the immaturity of the innovation, that there is no system out there yet that is ready for full scale implementation as a inter-bank infrastructure. Still, there is a lot of progress and testing going on. But even if a full-scale implementation comes within five years, 'is is still early days' also means that such an implementation might be a beginning and not an end. This implies that passive resistance and staying with legacy systems might work for a few more years, but eventually, more radical innovation has to come and for the established companies, it is better to start adopting it sooner rather than later.

The third part regards this regime response and the cooperation needed to relieve the regime from perceived pressures. There is wide consensus and a great deal of data that argues that the industry should build new systems *together*. The interview respondents have pointed out that BCT has spurred intense cooperation never before seen between banks and also more focus on *open innovation strategies* (Chesbrough, 2003) and acquisitions or support for tech startups through accelerator programs or incubators (Pizzala & Webster, 2015). This is perhaps one of the most clearly visible strategies that the incumbents show as a response to this disruptive niche.

The central argument of the extensive 'Fintech 2.0 Paper' is that, *"to realise the opportunity of Fintech 2.0, banks and fintechs will need to collaborate, each providing the other with what it now lacks, (...) Only by collaborating will the opportunity of Fintech 2.0 be realised"* (Santander InnoVentures et al., 2015, p. 5).

Even if cooperation and development seem to run smoothly, with big consortia like R3 constantly growing, there is most likely uncertainty and fierce competition hidden behind the scenes and a lot to be gained and lost when building partnerships. Big banks might be able to pull off a lot on their own, or at least use that as a negotiation tactics. Spokespersons from Santander, interviewed by Business Insider, illustrate this point:

"'What we see as the foundation use case, which is international payments, we don't really

need a coalition of 50 banks to make it work. We have ten major geographies. Just us connecting our ten major geographies will allow 100 million customers to make instant payments worldwide. If we partner with two or three banks similar to us we've got pretty much global coverage.'

But Faura adds: 'This thing will only be interesting if many banks take part and collaborate. We are talking and experimenting with several banks" (Williams-Grut, 2015).

In addition, the 'division of labour' in this new mixed environment of banks and tech-companies will also be negotiated and fought over and it is still very unclear how much the structure of the industry will be affected. Deloitte (2015, p. 5) argues that both large and small banks should team up with non-banks and payment providers to act as *product manufacturers* for the *front-end system of the non-banks*.

I would not say that this theme is acting as a strong political device for empowerment, but it underscores that the regime is under pressure and that incumbents are actively seeking to respond to these pressures. Since the resources needed for response are split between tech-firms and banks, cooperation and coordination is essential and generally preferred by the financial institutions. These are strong points about the 'adaptive capacity' of the regime, as discussed by Berkhout et al. (2004) and Smith et al. (2005). If both coordination and cooperation with resource rich tech-companies is achieved, the regime can significantly increase its ability to respond to these pressures.

This is 'the next Internet', we don't want to be left behind

What eventually shines through in the banks' reactions to this technology is the fear of being left behind:

"Many say that this is the next Internet, you know, the Internet of value. (...) We are forced to do something. We don't want to be left behind!" (Interview respondent).

The technology has been very hyped in the financial sector and since it is quite hard to understand, this has lead to a situation where people do not dare to make their own evaluations, but rely on the judgement of others and just 'jump on the train' to see what comes out of it. Many actors are simply afraid of missing out on 'the next big thing'. Saying that 'this is not going to work for us' is hard, since the technology is too complex to dismiss without thorough research. Even with research-backing, it might be too early to pass judgement at this stage. The strategy that remains is to get in there and experiment, use open innovation strategies and build up knowledge and networks. If something big comes out of it, one will hopefully be in a good position to utilize it. If not, at least one is in good company.

"An open question remains as to whether incumbent banks in the U.S. and Europe can

embrace innovation, not just talk about blockchain and hackathons, before Fintech competitors gain scale and distribution" (Citi GPS, 2016, p. 8).

This theme does not cater for a specific empowerment pattern. But as we have seen with other themes, it creates positive expectations about the future that justify the niche/regime involvement in the niche technology. It also says something about the circumstances under which incumbents choose to be active in niche technology development. Uncertainty, expectations and competition are the key words here, the factors that drive incumbents to a path of involvement rather than resistance. These are the incentives for increased resource allocation and high level coordination.

5.3.2 The Narrative of the Niche Actors

While the narratives of the niche actors are similar in some aspects, there are big differences in others. Less attention is paid to the parts that are similar.

The financial system is broken, and its technology ancient

The starting point for most niche actors when it comes to finance is that the current regime is flawed and based on outdated technology.

"The Banking System as we know it today, does not need help to become obsolete. It is doing a good job on its own" (Antonoupolous, 2015).

This is to some extent also acknowledged by the financial institutions, but at another level. What the niche represents is a new paradigm, a financial/payment system 'worthy of the 21st century'. The fact that someone is profiting from other people's trades because they own the infrastructure is seen as an evil anachronism. There is mistrust in authorities and fiat currencies that are depicted as slow, expensive and vulnerable to fraud, hacking and corruption since they are centralised and have major issues when it comes to privacy and censorship:

"*Governments can increase money supply at pretty much any whim, thereby decreasing the individual value of currency units. Bitcoin's supply, on the other hand, is already set and cannot be changed"* (Booker, 2016).

The current system is also seen as unfair and exclusive, especially for the poor population in developing countries:

"The result of this system is that more than 90% of the world population doesn't t have access to a credit card or even a bank account (Bouzid, 2013)*"*

The theme represents statements that primarily *"re-frame the past to challenge the*

prevailing regime in ways that emphasize future opportunities for the innovation" (Smith & Raven 2012, p. 1033), typical for a *stretch-pattern*. When it comes to transition pathway-factors, it supports the view that the niche is *disruptive* to the regime, that it will replace it rather than support it. The theme is also relevant to the transition pathways in that the niche actors consistently argue that the regime is suffering destabilisation or is on the brink of collapse, mostly due to internal dysfunction, but also outside pressures. In addition, the niche is argued to be fairly mature, which gives clear indications about how this narrative aims to influence perceptions of the timing factor.

Public before private

Niche actors have completely the opposite view on the private vs. public issue. In a way, that is what defines the groups. It is clear that there is consensus that a BCT needs to be open for all and non-hierarchic to capture 'the whole point' of the technology: The decentralisation, the censorship resistance, the network-centric rather than hierarchical structure, the power of open, permissionless innovation. Parallels are often drawn to the early days of the Internet to show why public systems are superior. And since the incumbents are going for private solutions, these are not set in very high regard. One of the main spokespersons for public blockchains expresses his views about the banks sarcastically:

"[The bankers say:] 'So that nice open, decentralised, borderless, peer-to-peer, open-innovation, open-access system you've built... Well, we can build one that is not open, not decentralised, not borderless, not open-innovation, and not open-access that we control completely.' (...) And they are missing the point!! Those are not the features to avoid, those are the features that makes it powerful! (...) [Decentralised blockchains] are inefficient because the inefficiency is the price you pay to get freedom. And if you don't care about freedom, why take the inefficiency?" (Antonoupolous, 2016, 1:04:20)

"Thankfully we have the banks demonstrating exactly what a centralised, lock-top, permissioned option is, so we can all steer clear of that!" (Antonoupolous, 2016, 1:50:09)

It is often claimed here that the banks are not actually building 'true blockchains', but watered down distributed ledgers, drained of their revolutionary traits. This has also been pointed out by the banks who often want to disassociate themselves from Bitcoin and other cryptocurrencies, the difference being that they stress that they are building efficient and scalable DLTs that are in compliance with regulations, while the niche actors claim they 'just don't get the point'.

Blockchain enthusiast ArthurB writes on his blog:

"The real advantage of decentralisation isn't in minimizing trust (...) it is in minimizing the risk of censorship. A set of known ledger maintainers can be compelled by law to censor the ledger, a decentralised application with pseudonymous participants does not suffer from this flaw" (ArthurB, 2015).

However, financial institutions would consider this a necessary *feature*, not a flaw. This is one of the 'political' differences between the financial institutions and most of the the niche actors. The CTO of R3 writes:

"*Censorship resistance is not an objective that is shared by most governments, regulators, banks or most individuals! No wonder there is so much controversy around the system. Perhaps it's just easier for respectable firms to steer well clear"* (Brown, 2015a).

It is clear that it is the inherently political and disruptive traits that are being 'negotiated' in these narratives. The reason why many in the community get frustrated, angry or disappointed over the fact that banks are now getting seriously involved in developing blockchains, is that they see the political aspects of it being taken out. When these idealistic dreams are turned into efficiency-schemes by 'the enemy', it comes with emotional reactions.

In other words, having *disruptive* relations and *stretching* the regime *is the point*, and the technology is just a means to this end.

The motto of Barcelona Bitcoin Community is chosen with care: *"You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete"* (bitcoinbarcelona.cat, n.d.)

Code is law

Public blockchains have an outspoken ideal to be outside of the financial regime, and indeed large parts of society. 'Code is law' expresses a libertarian ideal that one can code blockchains and smart contracts in a way that 'floats above jurisdiction'. The perfect blockchain-code therefore contains, in itself, all necessary functionality to be autonomous from any legal systems or human/lawyer interpretation. However, this ideal is contrasted with the fact that the immutability of the blockchain is in fact ultimately based on social consensus and not code. The code can be changed by the majority of users participating in the network. In fact the system is based largely on game theoretical assumptions about human actions, and more importantly the alignment of values within the community. This is why discussion forums plays such a large role in the niche. This is where values are debated and created and where the consensus narrative is formed. Without the narrative that 'the code is law', the immutability of the blockchain niche would openly be based on simple

majority democracy. This became painfully evident with the hard fork of the Ethereum blockchain. It also became evident that interacting with legal systems might be necessary for the niche to grow and mature (Antonoupolous, 2016).

"We are learning that there are some cases where you do indeed have to interact with the legal, sort of the authorities and the legal system outside of the blockchain. (...) I'm pretty sure that it's not going to be possible to toss aside, you know, 10000 years of legal development in the legal world, and just come up with your own code-as-law universe, and I think that at that intersection we're going to figure out how to do this in a much much better way" (Gün, 2016, 1:15:45)

Gün might want to be acknowledged as a neutral professor more than a 'blockchain activist', and here he argues that the niche community ought to employ more of a fit-strategy. He clearly does so due to the extreme stretch-pattern that is the current norm. The word 'stretch' does not really match here however, since 'tossing aside of 10000 years of legal development' and building a 'code is law universe' are is more 'replacing' than 'stretching'.

BCT is 'the new Internet', it spurs innovation, it is still early days

Some of the rhetoric are similar to the banks when it comes to the hopes and views on what BCT is and can do. Such as the comparisons to the early Internet, how it fosters new innovations by providing a new paradigm with new tools, platforms and organizational structures, and that we are only seeing the first stages of a great change. The main difference from the financial institutions, is that the niche actors usually points out the changing of institutions as either a goal in itself or as something coming automatically as blockchains progress. They hence use the same themes more to argue for a stretch-pattern and to *"argue for positive expectations about the future that justify the niche"* (Smith & Raven, p. 1033) than for making a point of the need to coordinate efforts to meet regime pressures.

5.3.3 Summary

Tables 3a and 3b summarize the identified themes and lists the characteristics that these themes show, regarding the factors determining transition pathways and regarding the empowerment patterns. *"(a) positive expectations about the future that justify the niche to wider audiences; (b) explicit claims for present-day niche friendly institutional reforms (or claims of present-day competitiveness within unchained selection environments); and (c) statements that re-frame the past to challenge the prevailing regime in ways that emphasize future opportunities for the innovation (and statements that defend regimes)*

Narrative of incumbents	Empowerment pattern support	Transition pathway factors
Bitcoin is bad, blockchain is good. Private before public.	fit, (stretch) a, b, c	BCT can be made symbiotic.
Private DLT gives efficiency rather than disruption.	fit, a, b	BCT can be made symbiotic. Incumbents can muster significant resources/capabilities for response.
BCT exposes friction and spurs innovation.	(fit/stretch), a, c	Articulation of selection pressures. Incumbents can muster significant resources/capabilities for response.
We don't know how to use BCT, but it is still early days and we are in it together.	n/a	Timing: Niche is not mature, but progressing fast. Resources/capabilities are split between niche and regime actors and incumbents argue for cooperation. Cooperation within industry successful so far.
This is the new Internet, we don't want to be left behind.	(fit/stretch), a	Hype and fear of missing out stimulates resource allocation and cooperation.

Table 3a. Summary of incumbents narratives. (Less pronounced findings in brackets.)

Narrative of niche actors	Empowerment pattern support	Transition pathway factors
The financial system is broken, and its technology ancient.	stretch, c	BCT is disruptive. The adaptive capacity of the regime is weak. Strong landscape pressures on fairly mature niche.
Public before private.	stretch, a, c	BCT is disruptive. Resources/capabilities for developing and understanding 'true' BCT is limited in the regime.
Code is law.	stretch, a/c, (b)	BCT is disruptive. Resources/capabilities for regulating public BCT is limited for the regime.
BCT is 'the new Internet', it spurs innovation, it is still early days.	(stretch), a	n/a

Table 3b. Summary of niche actors narratives. (Less pronounced findings in brackets.)

As the table shows, the overall narrative of the incumbents follow a fit-pattern and argues that blockchains can be made symbiotic to the regime, but acknowledge the disruptive nature of Bitcoin, which it also downplays as immature and useless at scale. It also show an articulation of selection pressures and argues for more cooperation and shows that allocating resources/capabilities to deal

with pressures is possible and a priority.

The narrative of the niche actors shows the opposite are strongly resembles a stretch-pattern, arguing that BCT is disruptive and that private blockchains are 'missing the point'. It is noticeable however that the their narrative lacks themes that argues for *'niche friendly institutional reforms'* which an effective stretch-narrative probably should have. The narrative is quite aggressive, follow a harsh line of criticism and providing an alternative rather than making attempts to merge niche and regime or seriously address current regulation by suggesting alternatives that policymakers and industry might actually find feasible. The current 'code is law', censorship resistance and full, but anonymous, transparency is unlikely to be institutionalized in its suggested form for a long time. The niche actors also points to the flaws and weakness of the regime and its limited capabilities to deal with BCT.

5.4 Analysis 3: How are Corda and Bitcoin Developed to Confront the RSEs?

To see how the designs of Corda and Bitcoin are selected for in the financial regime, each selection environment in the existing regime is considered in turn. This is not only a comparison between two competitive technologies, but also a demonstration of how one initial technology can be changed in different directions, to different purposes and empowered with different strategies. Ii is a deliberate comparison between 'apples and pears', not to rate them against each other, but to show how they evolve differently.

Each RSE is highlighted in **bold**.

5.4.1 Corda and the RSEs

Many parts of the existing **technologies and infrastructure** of the regime will of course be changed and challenged in the event of the introduction of Corda, since it is a substitution alternative to many current regime-technologies. But the surrounding technologies and infrastructure, whith which the new technology, must also be examined. According to the R3 CTO, Corda is "*built on industry-standard tools with a focus on interoperability and incremental deployment"* (Brown 2016). It is impossible for me to judge the feasibility of such a claim and to what degree it will be interoperable, but that at least is the vision and the narrative that is presented. What we can say is that Corda needs to compete with existing technology and aims to do so by proving its superiority in price/performance characteristics and by *fitting* the existing technologies

and infrastructure. Corda is also designed to not have a cryptocurrency and hence does not introduce a whole new dimension into the industry, making an easier fit to the current technology and routines.

The **structure of the industry** will probably be somewhat affected by an implementation of Corda. However, the important aspect of this is that the banks are *still central* in a Corda-based regime. As described in Chapter 4.6, Corda is designed to manage transactions *between* banks, not directly between the users as Bitcoin does. The 'power structure' is simply kept at the level of the company. This means that the financial regime can utilize the technology with only minor structural changes. Even if some roles will be different, it seems that this is viewed more as a new and healthy space for innovation and will not be fast and unexpected, giving established firms time to adapt (Brown, 2015a). Judging by how many banks have joined the R3-consortium, the forward looking attitude in the industry and the promises of great pay-offs (Santander InnoVentures et al., 2015), Corda seems to have the backing it needs from the industry. If the consortia manages to agree on an industry-ready design, it is doubtful that other financial institutions affected by structural changes could form a strong enough selection pressure to prevent an implementation. But some actors positions/existence will be challenged and those actors will resist and support existing technologies. In a short to medium term, the industry structure with the banks in the central position is probably strengthened by a successful implementation of Corda, but it is impossible to say what can happen in a medium to long term, which at this stage seems to be within the comfort-zone of the financial institutions. The big difference will be that "*Corda choreographs workflow between firms without a central controller"* (Brown 2016). However, the system will allow improved insight for regulators. In addition, since *"Corda transactions are validated by parties to the transaction rather than a broader pool of unrelated validators"* and therefore *"has no unnecessary global sharing of data"* (Brown 2016), the removal of the trusted third party is less problematic. So in short, while Corda might upset industry structures to some extent, it is backed by the major central actors who have designed Corda to fit existing structures.

The absence of a cryptocurrency and the intended preservation of industry structures also means that **user and market behaviours** are less affected. If it manages to provide lower fees on financial services this aligns with the values of the RSE. Furthermore, Corda is a back-office technology and the end users of financial services will probably not notice its implementation. There is no need for new user behaviours or references. In fact, the banks should be considered the users in this case, not the bank customers. Since the banks are also the developers, it is likely that Corda could be competitive within this RSA in its current state, if the final development is

successful.

The selection pressure from the **knowledge base** is difficult to judge based on the data available. My understanding is that this is not a major challenge, especially since Corda has no native cryptocurrency and it builds more on traditional knowledge and routines.

Compliance with **regulation and policy** has been one of the major priorities for R3 and what sets it apart from public BCTs. One of the key features of Corda is that it *"directly enables regulatory and supervisory observer nodes"* (Brown 2016). The system is designed to be in compliance with current regulations and is developed by the same institutions that are already in this business on a daily basis. If regulators can in fact increase their capacity to oversee the system through increased transparency and automatically include, for example, taxation and reporting schemes, Corda should be competitive within this RSE. In fact it would be one of its main strengths. Even if there are regulatory challenges with the technology, it does not demand changes in regulatory intention or major institutions, only technicalities have to be adjusted.

When it comes to **culture**, *centralised control* and *censorship* are key aspects. Status quo today is a belief that this is needed to manage a system. Even though Corda is a non-hierarchic account system for banks, Corda does not really challenge the cultural underpinnings of centralisation. The culture in the regime supports faster and cheaper transactions and the preservation of centralised control and censorship possibilities, which is just what Corda offers. However, shifting cultural preferences at the landscape-level towards more network-centric values might mean maintained pressures also on a Corda-based regime. These cultural tendencies are far from mainstream so far however, but as I have argued in Chapter 5.2, basing regime infrastructure on Corda would probably not relieve the regime from such pressures.

5.4.2 Bitcoin and the RSEs

We now move on to Bitcoin, to compare to how it relates to the RSEs of the financial regime. Again, not only the current state of the technology is considered, but also the *vision* of more mainstream adoption and continued growth.

Existing **technologies and infrastructure** in the financial regime are challenged by Bitcoin more as a complete competitor than a substitute for local technologies. Bitcoin and other public blockchains need a cryptocurrency and this introduces a whole new dimension into the sector. Bitcoin is not designed to cooperate with any of the established infrastructure or technology of the regime, but is a stand-alone architecture which fully supports itself based on the infrastructure of a public Internet. This also means that, unlike Corda, it does not need to outperform any existing

technology to be employed by the regime. It operates 'on the sideline' and slowly builds its own infrastructure and network of actors. As long as it caters for some users in specific ways better than the regime alternatives, it has a protected space for development. However, the picture gets more complex if also considering the 'extended technology base', i.e. the technologies and infrastructure deployed outside of the regime. Bitcoin may not be focused on fitting the technology or infrastructure of the *regime* at present, but it is in compliance with trend shifts in technology and culture *outside* the financial regime, and is aligned with recent decentralisation trends at landscape level. As Vinay Gupta puts it in a panel discussion:

"this sort of economics-narrative of decentralisation is efficient with the current technology base, therefore it is inevitable. It doesn't force a confrontation, it just accepts that the most efficient form will be a decentralised form, and so there will be a migration into these forms. (...) there are a lot of things that are pushing us towards this kind of decentralised world, so we're just another part of this global mega-trend. (...) it's as if we're looking to adapt to this inevitable decentralisation of society because of a multidimensional shift of the technology base. Then this [using Etherium] is a positive thing you can do to survive those transitions" (Ethereum Foundation, 2015, 14:20).

In other words, Bitcoin has a 'disruptive relation' to the financial regime, but is symbiotic and aligned with the rapidly shifting 'Internet regime'.

Also the **structure of the industry** will be severely affected by Bitcoin, or at east be quite different, in the proposed Bitcoin alternative. In a Bitcoin world, traditional banks are not central any more. National banks do not control money supply, interest rates or issue bitcoins. There might of course be parallel fiat-currencies, but the effects of monetary policy is lost if a significant slice of the economy is handling bitcoins. In a Bitcoin regime, wallets, fiat-exchanges, miners, alt-coins, peer-to-peer loan platforms and so on, make up the new structure of the industry, quite independent from the old. These are fundamental changes, and of course changes that will not be selected for within the RSE as long as the regime remains strong and functional.

When it comes to the **knowledge base,** it too will be changed. Our understanding of economics is based on the current system with our current ways of managging national currencies, interest rates and inflation and so on. We would have to build up a new knowledge base, relate to new theories and make new mistakes. The risk of going out into such unknown territory is much too big for any politician to take. The Bitcoin niche is therefore on its own and will have to take the hard route against established knowledge-networks, slowly building alternative knowledge.

Bitcoin demands new behaviours and routines of its **users and the market**. Compared to the long onboarding process of the current regime (showing ID at a counter to register a bank account,

installing Internet banking and finally making payments), Bitcoin is much simpler for a previously unbanked user. However, if you are already a bank customer, understanding a new system can be a big hurdle to cross. Users have to be convinced to make a switch from their old banks and national fiat-currencies to a bitcoin wallet. The majority of the market will most likely stay with existing alternatives rather than bitcoins, as long as the old system can be trusted.

Regarding **regulation and policy**, Bitcoin has, as already noted, taken an approach where it intentionally does not bind itself to any jurisdiction. Bitcoin has been hard to control by legislators mainly because there is no central authority and no issuer to regulate, no organization but anonymous users from across the globe who send information to each other on the Internet. A few countries have made bitcoins illegal, mainly since the only currency allowed is that issued by the national bank, but in most countries it is considered either a commodity or a legit currency, which usually affects taxation and regulation for traders (CoinDesk, 2014a). What is clear from this is that Bitcoin is not designed to fit smoothly into the current regulatory framework, but many policymakers see the potential of significant innovation are trying not to stifle this development. However, there remains significant problems regarding policy and regulation of cryptocurrencies, smart contracts and decentralised autonomous organisations since these in many ways represent new phenomena that force hitherto unforseen regulatory interpretations.

As already stated, *centralised control and censorship* are key aspects when it comes to **culture** in the financial regime. Status quo today is the belief that those traits are needed to manage a financial system. We base much of our society on this belief and on centralised, permissioned systems. These are norms cemented in politics and culture. There is a fear of letting the possibility of censorship go, it would mean loss of control and power. Censorship resistance is not what governments, banks or most individuals want (Brown, 2015a), not as long as the authorities with censorship-control can be trusted. While Corda does not challenge these norms, Bitcoin does. It claims that a financial system can be autonomous, peer-to-peer and based on economic incentives for individually selfish individuals and cryptography. All necessary governance is written into the protocol at launch or worked out through consensus by the community underway.

"trust in the code substitutes for the (socially and politically constituted) credibility of persons, institutions, and governments. It is this - not the anonymity or the cryptography or the economics - that makes Bitcoin novel in the long conversation about the nature of money."
(Maurer et al., 2013, p. 263)

5.4.3 Analytical interpretation

A summary of the above analysis (table 4), shows that Corda is developed into a form that is by enlarge compatible with the existing RSEs, following a fit-pattern. The R3 crew is pretty clear on this as they present the white-paper on Corda; *"we need tight linkage to the legal domain; (...) we must integrate and interoperate with existing financial infrastructure"* (…) *"in a way that is sympathetic to and addresses the needs of regulated financial institutions"* (Brown, 2016).

Such a pattern for the niche technology will lead to changes in the regime, but probably not radical changes. However, this is likely an easier way to empower a niche technology than to *stretch* the RSEs. Hence, the banks have a good chance at successfully implementing Corda or similar distributed ledgers, even if some degree of stretching of norms and routines and some competence-destroying is needed here as well. Such a development will probably lead to further changes as the regime adapts and settles around the new technology. To call Corda a competence enhancing 'add-on' would be to downplay the importance of substituting core regime infrastructure. However, the goal for Corda is clearly to utilise the many benefits of blockchain technology with *minimal* competence-destruction and impact on the regime.

On the other hand, Bitcoin is developed into a form that is not compatible with the existing RSEs. In fact it seems to contradict most of them and would never be selected for in unchanged RSEs. It is built to *disrupt the regime*. To be widely adopted, there will have to be a change in the way we think, act and regulate; undermining established regime structures and introducing niche institutions as new norms. Bitcoin aims to be the alternative we can transition to when/if the regime is destabilized in a typical stretch-pattern for a substitution pathway. For Bitcoin to really become the dominant technology, especially in such a socially important sector as finance, where stabilizing landscape features abound, it seems like very strong landscape pressures need to be put on the regime, like a second financial crisis, regional financial collapse, wars or political revolutions.

But a limitation with this analysis as that it considers a 'global' blockchain adoption. There are also possibilities for global *niche accumulation*. Bitcoin could, or have already become, institutionalized as an investment alternative to precious metals. Gold is not used for day-to-day transactions, but it still has an important role in the financial system as a store of value. Bitcoins share a number of traits with gold; scarce, highly prized and global demand. Surly you can not wear bitcoins as jewellery, but on the other hand they can be transferred to anyone across the globe in an instant. For entering this 'sub-regime' within the financial regime, there will not be the same deep disruption, stretching of norms and necessary stretching of RSEs. The empowerment processes we

have looked at above must hence be seen in perspective to what role the technology takes and that other RSEs are relevant when looking at the precious-metal-sub-regime.

Regime Selection Environment	**Corda**	**Bitcoin**
Technologies and infrastructure	Built to be compatible with existing technology. In line with network-centric technology development	Not compatible with regime-technology, but in line with network-centric technology development
Structure of the industry	Banks stays central	Completely new industry structure
Knowledge base	Minor challenge	Challenges knowledge on economics and monetary policy
Users and the market	Small effects from back-office technology	Demands new routines from buyers and sellers and changes market structures
Regulation and policy	Helps compliance	New definitions and regulation necessary. 'Floats on top' of jurisdiction.
Culture	Keeps centralised control and censorship	Libertarian/anarchic/ democratic cultural values
Empowerment pattern	**Fit-and-conform**	**Stretch-and-transform**
Nature of interaction	**Symbiotic-disruptive**	**Disruptive**

Table 4. Corda, Bitcoin and the RSEs.
The table shows how Corda poses some challenges to the RSEs and regime competence but fits relatively well to existing structures, making competitiveness against existing technologies feasible within largely unchanged RSEs. It also shows how Bitcoin is disruptive, poses major challenges to the RSEs and that significant *stretch* of institutions are necessary to achieve competitiveness against existing technologies.

6 Discussion and Conclusions

6.1 Discussing Findings and Answering the Research Question

How is blockchain technology developed and empowered within the socio-technical system of finance by different actor-groups?

It is clear from this case that the banks take an *active* role, not in resisting, but in experimenting with and developing this potentially disruptive technology. However, they have rallied behind a *fit-pattern*, doing what they can to reconfigure the technology into a design that is less radical in terms of upsetting power structures. Their version must necessarily maintain their central role in the industry. The incumbents frame the technology as a performance-enhancing substitute to existing technologies This shows that, when regime pressures are articulated and radical niche innovations show potential to also benefit the incumbents in some configurations, active resistance can be judged as too defensive and leading to missed opportunities and stagnating capabilities. Under gradual, disruptive landscape pressures, incumbents may instead try to mitigate the risk of disruption through engaging in reconfiguration of the niche innovation.

According to the interview respondents, as long as banks can comply with regulatory demands, they want to be at the forefront of the technological development, whether that technology may end up risking their positions or not in the *long* run. The banks will of course not push for their own disruption, but they will involve actively in path-breaking niche activities in order to be positioned in a front seat as changes in the regime occurs, which they see as likely one way or another. Moreover, since blockchain technology can be shaped to solve different problems, what initially is perceived of as having disruptive potential, might instead turn out to be symbiotic and ease the pressure on the regime. It is easy to associate such a fit-pattern with incremental innovation. However, the process I talk about here is relative to the starting point. If you start with a truly disruptive transition and manage to 'tame it' to some extent, it might still be significantly disruptive. Substitution of core technologies in the banking sector would really be a radical change, even under controlled circumstances led by incumbents.

Three factors seem relevant for such a situation to appear: (1) Gradual, disruptive landscape pressures, that are articulated by the incumbents, and with destabilizing effects already observed in other industries. (2) Initially disruptive, but potentially symbiotic, technology with somewhat general purpose. (3) Increased competition from other sectors or entrants. Note however that more

empirical evidence is necessary to generalize these conclusions.

The comparison made to the niche actors innovation activities, demonstrates how they are more interested in the technology's disruptive potential and political traits. The analysis concludes that niche actors follow a 'stretch-and-transform' pattern (Smith & Raven, 2012), aiming to change not just the technology, but also the values, norms and power structures of the regime. In stark contrast to the incumbents, they frame blockchain technology as a truly disruptive, general purpose technology that will decentralise power structures and potentially even make banks obsolete. There are strong network-centric and libertarian values in the niche and their general goal can be explained as 'giving the people control over their own assets'.

The niche actors *stretch-pattern* and their relatively unified goal that the technology should be used to realize societal changes means aiming for a *substitution pathway*. They are, at least for now, less interested in negotiating the political traits of the technology to 'sell it' more easily to the regime, as this would most likely result in a more watered down version of the technology. However, their maintained 'stubbornness', will keep exerting a force and inspiration for change of institutions in their direction. If the regime only transforms the slightest in the direction of the niche, it can be accredited to such a stretch-and-transform pattern and claimed as a partial victory. For their substitution-strategy to fully succeed however, very strong landscape pressures would be necessary. This might be feasible locally, in regions of political and financial turmoil. Such multi-level dynamics are well known to transition researchers (Geels, 2002; Rip & Kemp, 1998; Smith et al., 2010).

6.2 Towards an Integrated Framework?

It it still too early to say that a STT will in fact happen in this studied case. Due to this, it is even more uncertain what *transition pathway* such a transition could follow. The transition pathways are in that regard not a suitable framework for forecasting, especially not when based on observations taken before a transition has even been initiated. An analysis on transition pathways needs an historical context to identify the processes and patterns. However, my aim in this thesis was to show connections between the struggles between actors over a disruprive technology and how this affected the long term trajectories of the regime and technology. This question is not possible to answer based solely on empirical evidence. It is a question that needs to engage theoretical constructs and connect the findings from the case to with those theories to arrive at a conclusion.

Fortunately, we have a suitable frameworks and empirical findings to base such a discussion on. We just need to connect them into a model. In the previous chapter, that discussed the findings

from the case, we saw that even though it was uncertan which transition pathway was likely, it was clear what *the trends* where that resulted from the observed empowerment patterns. By combining the classic MLP model (figure 1), the transition pathways diagram (figure 2) and the empowerment pattern-concept with the observed trends from the empowerment processes, it is possible to build an integrated model that shows how these empowerment patterns *relates* to different 'pathway-scenarios'. The model also takes the 'outside-in' perspective, in line with how Geels et al. (2016) presents the framework. They use it to *"develop alternative understandings of shifts between transition pathways, which depend less on external landscape pressure and more on shifting actor coalitions,struggles, and adjustments in formal rules and institutions."* (Geels et al. 2016, p. 897). The model is built up in four successive steps and exemplified with dynamics from the case.

In the original 'outside-in perspective' on transition pathways (cf. Geels & Schot, 2007), the transition pathway is determined by the timing and nature of the interactions. The unit of analysis is the transition; There is hence only one data point: 'the position' of the transition in the diagram. With the 'inside-out perspective' however, focus is on the 'struggles over technology deployment between actors', and the situation is much more complex (Geels et al. 2916). Such a model has to include a multitude of actors, or at least niches, that are struggling and negotiating, while under influence of landscape pressures and relating to the regime. Selection of niches that eventually are included in the regime must also be represented as well as processes of maturing and shifting in nature (becoming more or less disruptive/symbiotic).

In figure 8, the difference between the outside-in and the inside out perspective is visualized. Instead of considering the position of the 'transition' (A), the inside-out perspective considers the

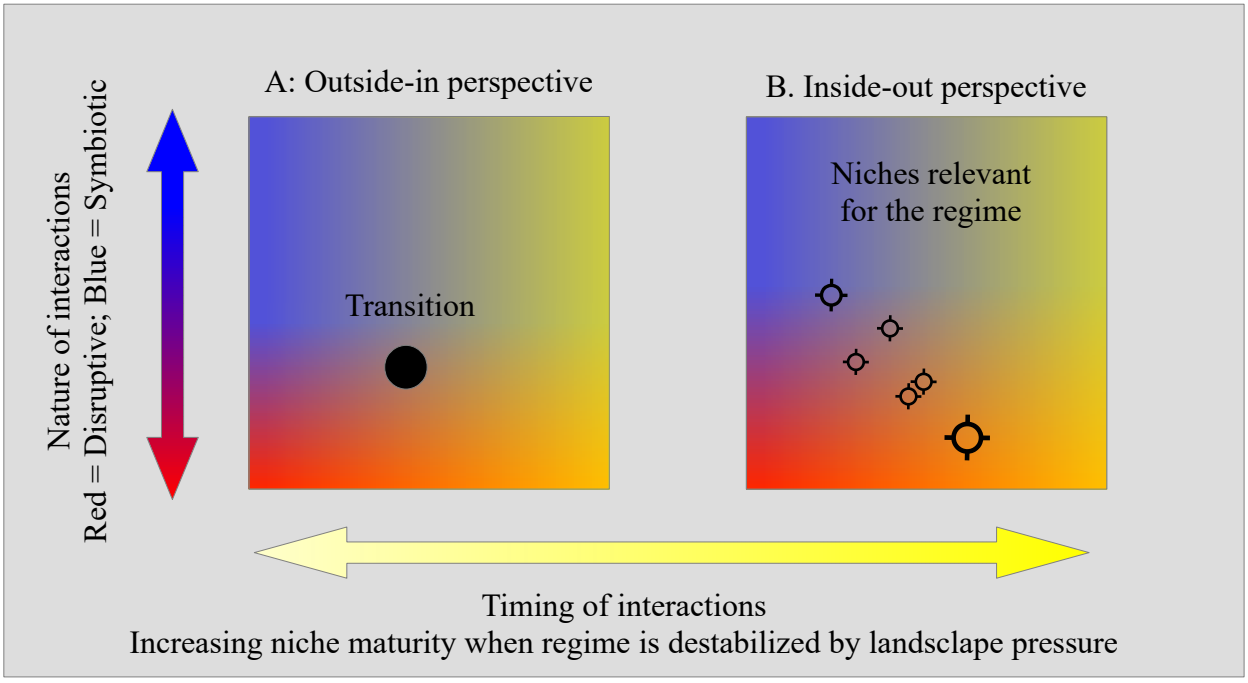

Figure 8. Outside-in and Inside-out perspectives on transition pathways.

position all of niches *relevant* for the regime (B). The model can also illustrate actors, with similar logic and graphics, but to keep the amount of dots in the diagram at a minimum, only a few niches are plotted in the diagram.

Introducing *movement* of niches in the model represents that a niche is becoming either more or less disruptive, (vertical movement), or more or less mature (horizontal movement). The axes of the model corresponds in essence with the original factors 'nature' and 'timing', although they where never depicted graphically. The analysis has showed that fit- and stretch-patterns where identifiable for both actor-groups and where meant to either move the niche in direction of the regime and become more symbiotic (i.e. fit-pattern), or was an attempt to stretch regime structures or norms and move them towards the niche, which means 'mobilizing the disruptive potential' of the niche, rather than making the niche more disruptive (i.e. stretch-pattern) (cf. Smith & Raven, 2012). Fit-patterns then, means more symbiotic interactions and a movement upwards in the model, which is of importance for the transition pathways. Figure 9 illustrates how Corda has successfully employed a fit-pattern and moved towards the top. It has also matured somewhat, representing a

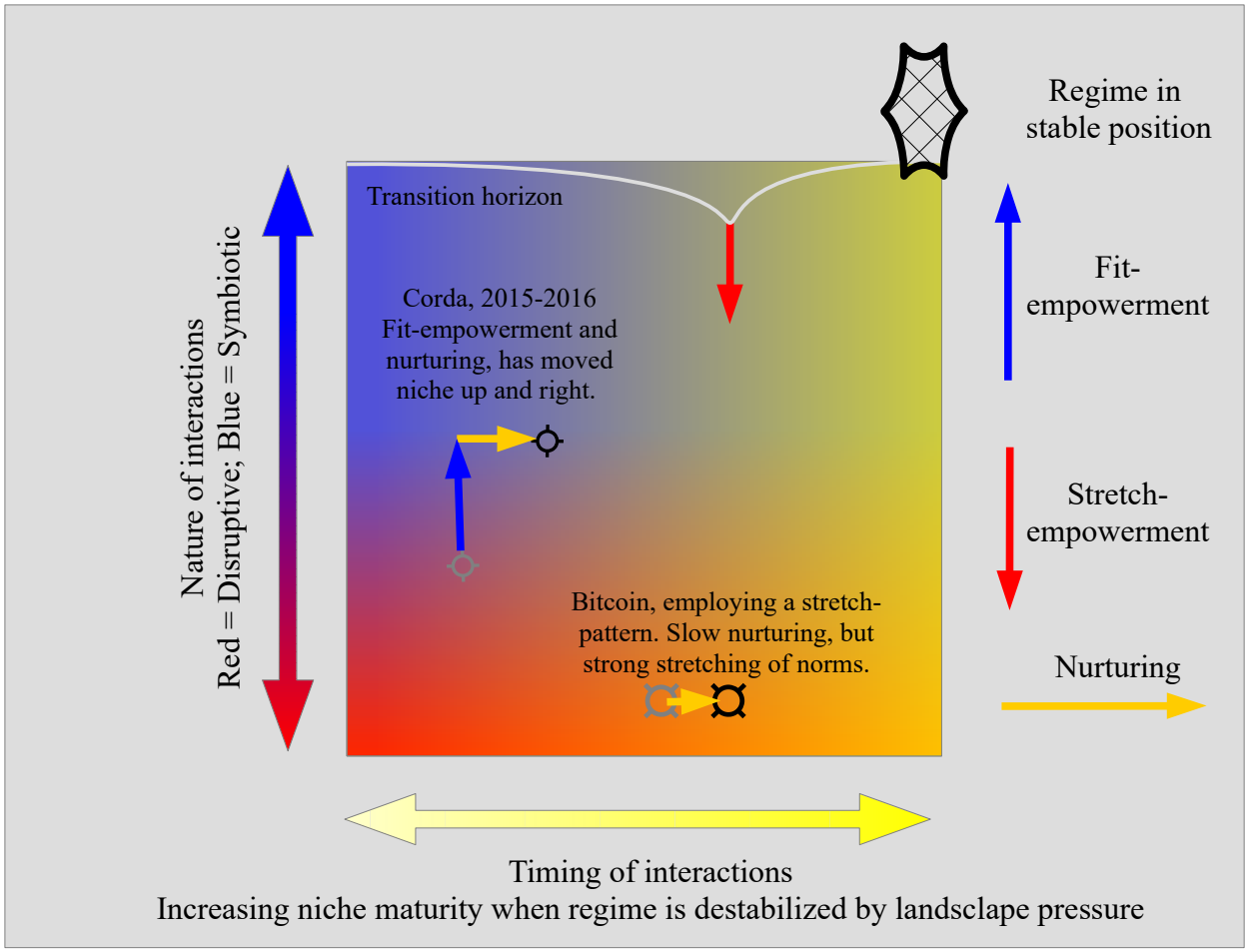

Figure 9. Half-integrated graphical model.

small movement to the right, i.e. been *nurtured* (Smith & Raven, 2012).

Illustrating the stretch-pattern is somewhat more advanced. A niche is not really becoming more disruptive through employment of a stretch-pattern. Therefore, stretching does not represent a simple movement of the niche downwards, but it rather involves moving regime, or landscape, norms towards the niche. This increases destabilization of the regime and hence stretch-patterns result in a weakening of the regime and a lower barrier for transition. However, it could be argued that the niche could move downwards as a result of changed socio-technical structures, in a stretch-*development* pattern, i.e. 'empowerment + nurturing'. As the illustration is drawn, and as the analysis is interpreted, the stretching of regime norms that the Bitcoin niche is managing to perform, is far from enough for the niche to be competitive with established technologies.

The last possible movement is to the left. Niches that are no longer nurtured but starts to stagnate will most likely loose their support and become 'less mature', representing a movement to the left. Shifting expectations and value structures also play a part here and can hence set a niche back in maturity (Geels et al 2016).

The implications of this 'inside-out' understanding of development patterns within the transition pathway context, means a re-conceptualization of the 'timing' factor. Shifts 'backwards', i.e. to the left, on this scale is possible, even though there has not been a 'change in timing', i.e. when landscape pressure occurs in relation to the maturity of the niche (Geels & Schot, 2007, p. 405). Instead such shifts represents changes in perceptions, expectations and institutional embeddedness of the technology. If problems emerge and the niche technology meet difficulties that lowers expectations, this represents a movement back to the left. We have for example seen some major hacker attacks that have affected the blockchain niche negatively.

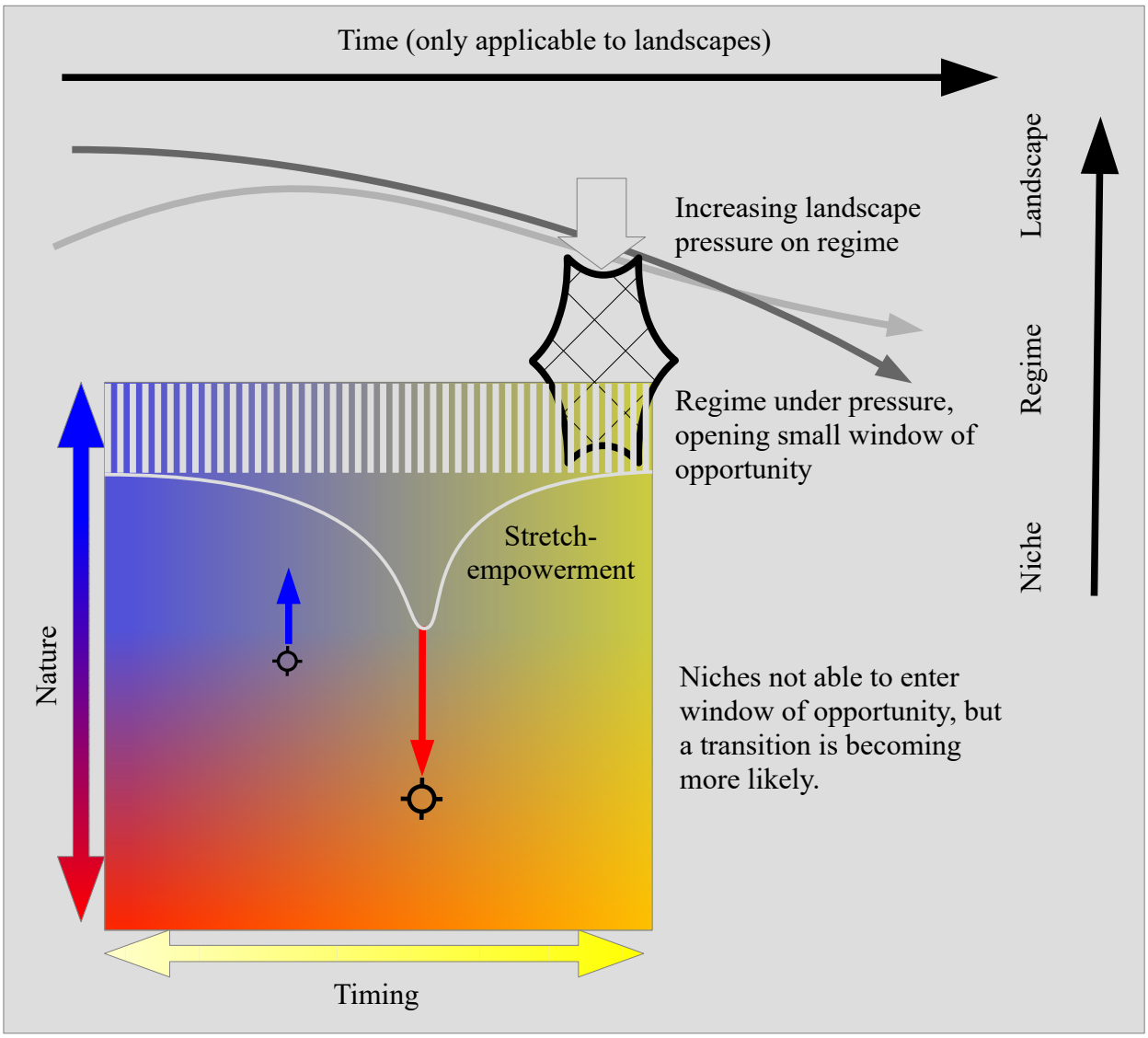

Figure 10. The suggested model for an integrated framework. 'The Enacted Transitions framework'.

In figure 10, landscape levels are introduced in the model, and therefore also regime pressure. The financial regime is depicted as being under some pressure, in line with the analysis. The new 'global' axes introduced in figure 10 (black arrows), are the same as in the MLP-illusrtation (figure 1). However, they are *not valid inside* the transition pathway diagram. Since the vertical axis is not used in the original model (figure 1), nor here, to describe the 'shape' of landscapes pressures, it is not really necessary to include in this model. It can only be used to describe the structural level in terms of 'niche; regime; landscape'.

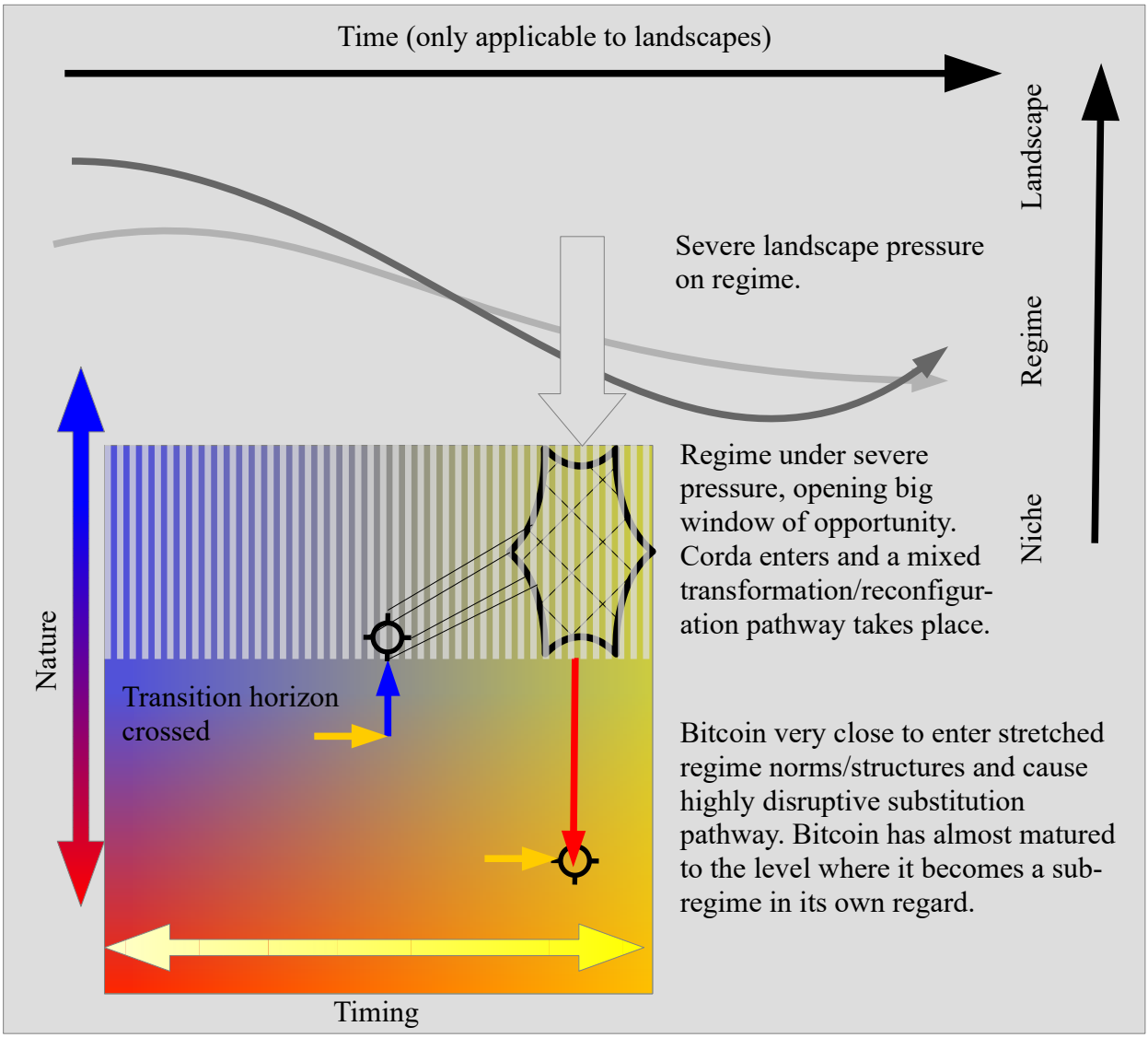

Figure 11. A transition scenario for the case showing a mixed transformation/ reconfiguration pathway. The figure shows an illustrative scenario for the case, in which landscape pressures have increased, opened a big window of opportunity. Corda have been successfully nurtured and empowered through a fit-and-conform pattern. Bitcoin is keeping its stretch-pattern and is maturing to the level where it is almost a sub-regime, but does not really succeed to stretch regime structures far enough so as to achieve a substitution pathway.

In figure 11 we see that conditions are met for a transition of a mixed type: transformation/ reconfiguration. This scenario would mean that the observed fit-pattern employed by the incumbents in developing Corda where successful and that they 'reached the window of opportunity' in time before a growing Bitcoin niche could result in a more disruptive substitution. However, if the new reorientation of the regime, that results from implementing Corda, does not ease the landscape pressures, the Bitcoin niche is still a threat to the regime in this example. This shows a number of capacities for the model. It explains how different pathways are initiated based on a

combination of endogenous enactment and landscape pressures. It explains to a large extent which, out of several relevant niches, that becomes incorporated/substitutes the regime, i.e. it reaches the window of opportunity before others, or deeper into it. It describes how different actors can utilize different strategies to achieve their goals and preferred transition pathway. The model also happen to incorporate the 'adaptive capacity' of the regime (Berkhout et al. 2004, Smithe et al. 2005). A sign that the model is worthwhile, other than for explanatory reasons, is that it makes 'predictions' regarding a regime's adaptive capacity: It shows how regimes are affected by pressure from landscapes and stretching from disruptive niches. Incumbents, here conceptualized as 'regime actors', can be more or less skilled in their niche-activities. The model has hence suggested three distinct features of regime's adaptive capacity: The 'buoyancy' - a regime's capacity to adapt to landscape pressures; The 'tightness' - a regimes capacity to resist niche's stretch-activities; The 'exploration ability' - a regime's ability to identify and fit symbiotic niches to its structure. Judging whether these 'predicted' features actually corresponds to real world phenomena or are already described in the scientific literature as theoretical concepts, lies well beyond the scope of this thesis. However, they seem sound and interesting as starting points for further research, if only a literature review to identify research that can enrich MLP with new dimensions.

Another interesting dynamic in the model is how one niche, that performs stretch-activities, creates a bigger window of opportunity, which means that other niches, close to the 'transition horizon', can enter the window and initiate a transition. Several disruptive and forceful niches all employing stretch-patterns can then create synergy effects on behalf of the niches.

It also remains to be demonstrated how further enactment of a transition that is already set in motion should best be described in the model. Since my case only showed the enactment of niche struggles under a stable regime, I will not develop these aspects here. However, the model seems to capture such dynamics in much the same was as I have described transition initiation.

Although I have now demonstrated some of the dynamics the model suggests, it should be stressed that it is only a suggested outline, based on very limited data. The model needs to be extensively tested and exemplified to be trustworthy. Although the frameworks the model builds upon are supported by extensive empirical observations, I have only used one case to show how the concepts in these integrated frameworks, interact in real world situations.

6.3 *Concluding remarks*

The study concludes that incumbents under certain circumstances actively take part in development of disruptive technologies, which in this case leads to a less disruptive technology. This differs from the normal assumption that incumbents are locked-in and path-dependent, but corroborate with other recent findings in the transition literature (Smith, 2006; Geels et al., 2016). The implication is that lock-in and path dependency in incumbents can not be assumed, but should be determined through contextual analysis.

This thesis have explored how transitions can be initiated from an 'inside-out' perspective, based on the ongoing struggles between actors in combination with outside forces. It aimed to find connections between enacted innovation activities, before a transition was initiated, and the subsequent transition pathways. Through studying blockchain technology within the financial sector it was found that both incumbents and niche actors where engaged in innovation activities of this disruptive. The analysis showed that the actor groups employed different empowerment patterns to make the innovation competitive: The incumbents followed a 'fit-and-conform' pattern, aiming to reconfigure blockchain technology into a performance-enhancing substitute to existing technologies that fits regime structures. In contrast, the niche actor's employ a 'stretch-and-transform' pattern, maximising the technology's disruptive potential, aiming to decentralise power structures and even make banks obsolete. The different empowerment patterns where found to have different *relational effect* to the determining factors for transition pathways. This means that, although it could not be shown *which* transition pathway that where likely, it could show how the enactments and struggles of the actors gave clear indications as to where they where aiming and what 'direction' their actions had, in relation to the different transition pathways. The actions of the incumbents consistently lead to less disruptive technology while the niche-actors rather remained far from mainstream adaption of their blockchain applications, as long as they could keep certain traits in the technology with 'political agenda'. In other words, they where not interested in compromising the censorship resistance, public nature and disintermediating effects of the technology just to see it utilized on an industry level. Since these strategies are connected to the determinants of the transition pathways, i.e. the nature of the interactions, these strategies can have significant affects on the future trajectory of the regime in case of a regime transition.

Building on these findings, an illustrated model for enacted transitions that integrates the transition pathways and the empowerment patterns where created. The model was found to be

promising in more than this regard and a number of suggestions for further research was made based on the model. The study suggests further research that can determine whether this suggested outline for an integrated framework is fruitful. The conclusion regarding the incumbents and their path-breaking innovation activities is that incumbents under certain circumstances prefer to actively take part in development of disruptive technologies and that this can in fact be a good mitigation tactics for exposed industries. These findings differs from the normal assumption that incumbents are locked-in and path-dependent, but corroborate with other recent findings in the transition literature (Smith, 2006; Geels et al., 2016). The implication is that lock-in and path dependency in incumbents can not be assumed, but should be determined through contextual analysis.

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APPENDIX 1
Semi-structured interview guide – Blockchain case study
Banks/Financial incumbents

Name:
Representing organization:
Position:

Routine check:
Introduce the study
Ask about recording
Ask about use of name and quotations
Sign agreement

”If you can not answer a question abut your firm, just answer with your opinion for the sector in general.”

- Can you tell the brief story of how the firm fist learned about BTC and who brought that knowledge
- How has the internal discourse and development been since?
- What do people say about BCT in the luch room?
- What business problems is it that BCT helps banks to solve?
- What actions have been taken in understanding, adapting to and using BTC by your firm/industry? Any ongoing projects?
- Has this spurred new relationships and cooperations?
- How do you think that BCT will affect the sector in general in the coming years? What would be the difference from today?
- What are your vision for the use of BCT in your firm and in the sector at large?
- What do you see as the important factors determining the adoption of BCT in the finance sector?
- How does BCT relate to bank-regulation?
- How do you judge the maturity of BCT?
- Would you say that BCT is disruptive for your organization?
- In general, do you see BCT as a threat or an opportunity for the organization?
- What would be the greatest challenge posed on the organization from a wider spread of BTC?
- Anything you would like to add?