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Blockchain from Public Administration Perspective: Case of Estonia

Master's Thesis
Public Administration

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Abstract

Blockchain is a digital distributed ledger that allows parties to transact without a trusted intermediary. Increasing investments in blockchain technology in recent years have resulted in disruption in many sectors. Blockchain is a general function technology that can reduce transaction costs, but some proponents see it as a new form of governance. Currently, the majority of blockchain academic literature takes a wide approach or focuses on specific commercial sectors. The aim of this thesis is to analyse blockchain from a public administration perspective. The theoretical framework combines governance, public administration reform frameworks and e-governance. The empirical part focuses on Estonia, a leading country in terms of blockchain adoption in the public sector. Data is gathered with document analysis and semi-structured interviews. The Estonian case demonstrates a general benefit to using blockchain in public administration. The Estonian X-Road is a broader platform providing value across the public sector, allowing organisations to provide more intuitive and better e-services. However, within the context of a single organisation, the blockchain use case is still vague. In regards to governance frameworks, blockchain may prove as a valuable e-governance tool within both New Public Governance and Neo-Weberian State frameworks. Blockchain could be used as a platform for managing networks in the New Public Governance context and it can be used to additionally increase public sector efficiency in the Neo-Weberian State framework. Future scenarios for blockchain include open data government, smart contracts and tailored public services as means to make the most of blockchain.

Keywords: **public administration reform, blockchain, Estonia, e-governance**

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Introduction

Blockchain is a decentralised ledger, distributed between the participants of the blockchain network. Effectively, blockchain allows to cut out the middlemen: in the case of Bitcoin, the blockchain network without a central figure guarantees the transfer of funds and the continuity of legitimate data. Trust and security is achieved with distributing the blockchain between all participants. The advances of blockchain technology are already disrupting industries such as finance, law, energy, insurance, logistics and governance, as an effort to reduce transaction costs. The technology is advancing in a rapid pace and will change how assets are exchanged, validated, shared and accessed through digital networks (European Commission 2018, 12). Moreover, blockchain is a general purpose technology (such as steam engines or the internet) and at the same time blockchain may provide a new form of coordination in addition to markets, networks and hierarchies (Davidson et al 2016, 32). This indicates that there is a wider array of uses for blockchain technology in addition to cryptocurrencies. Blockchain in the context of public administration would fall in the category of e-governance. Information and communication technology is an important part of contemporary public administration (hereinafter PA) reform (Tõnurist et al 2016, 2), having changed public service delivery and increasing the standards of public services.

Considering the rate at which blockchain is experimented with, there is a lack of academic literature on blockchain governance[1] and the majority of existing studies focus on the potential and adoption of blockchain in non-governmental sectors. As blockchain itself is a new technology, the academic discussion of blockchain governance is still growing. As of the writing of this thesis, there are only few academic studies written specifically on the topic of PA and blockchain (see Atzori 2015 and Davidson et al 2016) and a few blockchain project case studies (see Backfeed by Pazaitis et al and Davidson et al) that provide input for a general governance perspective research. Regardless, studies have demonstrated that the field is in a dire need of analysis from a non-IT perspective. The existing blockchain governance literature has approached blockchain from a political or fundamental standpoint. Atzori's (2015) main conclusion is that blockchain should be discussed as part of organisational theory and blockchain should be rejected as a standalone political theory (Atzori 2015,

[1] Generally, blockchain governance is understood as the general governing or management of a blockchain. In the context of this thesis, blockchain governance refers to the use of blockchain in public administration.

31), but their study takes a rather wide approach regarding blockchain and the discussion of blockchain in PA is not comprehensive. Another key study in blockchain governance is by Davidson et al (2016), where they go as far as to argue that blockchain is a new type of institution, competing with markets and networks. This perspective somewhat overlaps with Atzori's conclusion of blockchain being subject to organisational theory but they extend this view by arguing that blockchains allow to serve people that are currently not served by market, hierarchical or governmental coordination mechanisms. This notion serves as input for a PA perspective where blockchain is used as a tool for public service delivery, thus reinforcing the need for blockchain governance discussion.

This thesis is aimed to be an exploratory case study, which is best suited in a situation where there are few studies to rely on (Labaree 2018). The thesis at hand is not validating a hypothesis or presenting concrete blockchain empirical cases, but rather explores the topic of blockchain in the public sector, the aim is to contribute to the academic discussion of blockchain governance. **Qualitative** research methods are used to analyse Estonian public sector organisations in a PA framework context. The organisations are selected based on their routines and cooperation with other organisations. Data is gathered via document analysis and interviews with public servants. The interviews were split in two parts: in the first part, the interviewee was asked questions about management and governance in their organisation; in the second part, the interviewee was asked how technological solutions have affected governance and what are future plans for IT in that organisation. Estonia has been selected as the case study country because on one hand, Estonia has relevant literature regarding PA trajectories (literature from Randma-Liiv and Drechsler) and on the other hand, Estonia is among the countries currently using blockchain technology (Estonia's X-Road). Detailed description for choosing specific organisations is written in detail in each sub-chapter of the empirical part (chapter 2).

The structure of this thesis is as follows. First, the theoretical framework is developed with definitions of governance and the history of public administration reform frameworks. The focus is on why and how public administration paradigms evolve. Thereafter, contemporary governance frameworks are discussed in detail, focusing on New Public Governance and Neo-Weberian State theory. In addition, an overview of e-governance provides supplementary context for blockchain within the public sector. The theoretical part ends with an overview of blockchain itself, with focus on two main characteristics:

immutability and access type, and chapter 1 concludes with a synthesis of the theoretical model. The theoretical part is followed by the Estonian case study. The first part of the empirical discussion will provide a description of the research methodology. Thereafter, the Estonian case is introduced alongside an overview of the main Estonian blockchain project X-Road. Further, the several interviews conducted with high ranking officials will be analysed to gather input for the discussion part. The thesis ends with an in-depth discussion, attempting to provide answers and explanation to the research questions below. The research question and supportive sub-questions are the following:

- How could blockchain technology benefit public administration in the context of reform frameworks?
    - What are the contemporary public administration reform frameworks?
    - How does blockchain fit into the narrative of contemporary public administration reform framework in Estonia?
    - What are the potential use cases of blockchain in the context of public administration?

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1. Theoretical Framework

This chapter is going to introduce three main theoretical concepts: the concept of governance, public administration reform frameworks, e-governance and will give a brief overview of the main relevant aspects of blockchain. The chapter explores how the academic discussion of PA has developed through different paradigms and what the relevant contemporary frameworks are. The general aim of the chosen theoretical framework is to explore the role of the government in governance and how to tools for governance are selected. The chapter examines connections between blockchain technology and governance theory, whether the use of blockchain has overlapping elements with PA reform frameworks.

Blockchain as a novel network technology has multiple approaches for academic discussion. Transaction cost theory or technological capacity theory could provide explanation for the impact of blockchain on a specific organisational or industry level. However, the technology has not yet reached widespread adoption, as well as being in the early stages of development and having a lack of empirical evidence for a technological capacity approach. Using theoretical frameworks of PA reform allows to draw conclusions on how the technology would fit into contemporary reform frameworks, if at all. The invention of the internet is a good analogue to illuminate of how technology has evolved to supplement public service delivery or has transformed them. While the internet was first used as means to reduce administrative costs, it has developed into a wider platform for government-citizen interaction, it has developed into a tool of governance.

1.1. Governance

Governance, although a key concept in terms of public administration paradigm or reform framework discussion, does not have a definition that is universally agreed upon. The definition of governance varies depending on the context. Governance can refer to the horizontal relationships between public sector organisations and other organisations (Osbourne 2010, 304) or to Drechsler (2004) definition of "steering mechanisms in a certain political unit, emphasizing the interaction of State, Business, and Society players". Each of the definitions of governance focuses on a different element of the same

cluster of ideas. What most of the definitions have in common is that they refer to it as an overall concept of running and managing the public sector and its relationship with other actors. While governance itself is a positive concept, it is often closely linked with another key term "Good Governance", which is a normative concept (Drechsler 2004, 388). The concept of Good Governance changes in time and is often dictated by international organisations such as OECD (ibid. 389) and by academics in the field of PA. Four different approaches to governance are outlined by Klijn:

- **Governance as corporate governance**: "governance refers to the principles of a properly functioning administration. Such an administration is characterized by the fair treatment of citizens and an unambiguous organisation that adheres to the basic principles of the rule of law. The emphasis here is on the operation of government, rather than on the manner in which government is organised. However, this view of governance adds little to classical ideas of government or even bureaucracy" (Osbourne 2010, 303).

- **Governance as new public management**: "a means of improving performance and accountability or a form of market governance (Osborne and Gaebler 1992; Bekkers et al. 2007). Under this definition, the role of governments is to steer rather than to row (Osborne and Gaebler 1992). The focus of government should be to set goals, and not to control the implementation process." (ibid.).

- **Governance as multi-level governance**: refers to the concept of achieving consensus and results in a multi-actor environment (Osbourne 2010, 304). One of the most apparent examples is the discussion of environmental issues, in which an array of actors from the public, private and third sector are involved, all of them with different incentives and intentions regarding policy outcome.

- **Governance as network governance**: "Governance takes place mainly within the fluid network of public and non-public actors, and the interaction between these groups makes the processes of governance complex and difficult to manage. Consequently, the steering and management strategies required are different from that used in more classical approaches." (Osbourne 2010, 305).

The aforementioned definitions of governance all abide in different PA paradigms. Comparing the different definitions of governance, definitions 3 and 4 both focus on governance being a concept that manifests in networks (Osbourne 2010, 305). Modern concept of governance has developed into a word that means moving away from traditional vertical hierarchy organisations to network type governance (ibid.), as it views the cooperation of the state and civil society essential to the functioning of the government. Thus in a way, being able to govern is not just managing the resources of the public sector itself, but utilise resources from other sectors. The bureaucratic entity is not something that is isolated, but rather a central machinery, which keeps the economy and civil society moving. A "machinery" analogue is appropriate, as it implies that if one of the parts is operating inefficiently, it affects the other parts attached to the machinery. In order to have the machinery of society moving consistently, "frameworks" are needed to achieve harmony.

1.2. Public Administration Reform

The discussion of the nature of PA reform frameworks[2] is often vague (Drechsler 2013, 322; Osbourne 2010, 4). For example: is NPM a paradigm? Is it perhaps a theory? Or is it a transitory phase between traditional PA and NPG? All these theoretical issues have to do with PA being a contextual phenomenon. PA scholars often have back and forth discussion of PA frameworks, often ending in the conclusion that sometimes in some cases some tools may work (Drechsler and Randma-Liiv 2015, 6). In addition to PA evolving through trial and error, the academic field is constantly shaped through the social and economic sphere of society. Globalization has 'opened up' governments and forced them to spend more resources on networks, participate in international political discussions and steer their economies through global competition (ibid. 8). Therefore the context of reform has expanded, included new concepts and ideas. Semantics do not fall under the scope of this discussion and reform is defined as Pollitt and Bouckaert (2011) have defined it: "Deliberate changes to the structures and processes of public sector organizations with the objective of getting them (in some sense) to run better." NPM, NPG and NWS will be referred to as "frameworks", a cluster of ideas, tendencies and

[2] The semantic discussion whether NPG and NWS are paradigms, regimes or anything else falls outside the scope of this thesis. NPG, NWS, NPM and others are simply referred to as "frameworks".

priorities. The differentiation of frameworks is necessary for mainly one reason, policy stability and continuity.

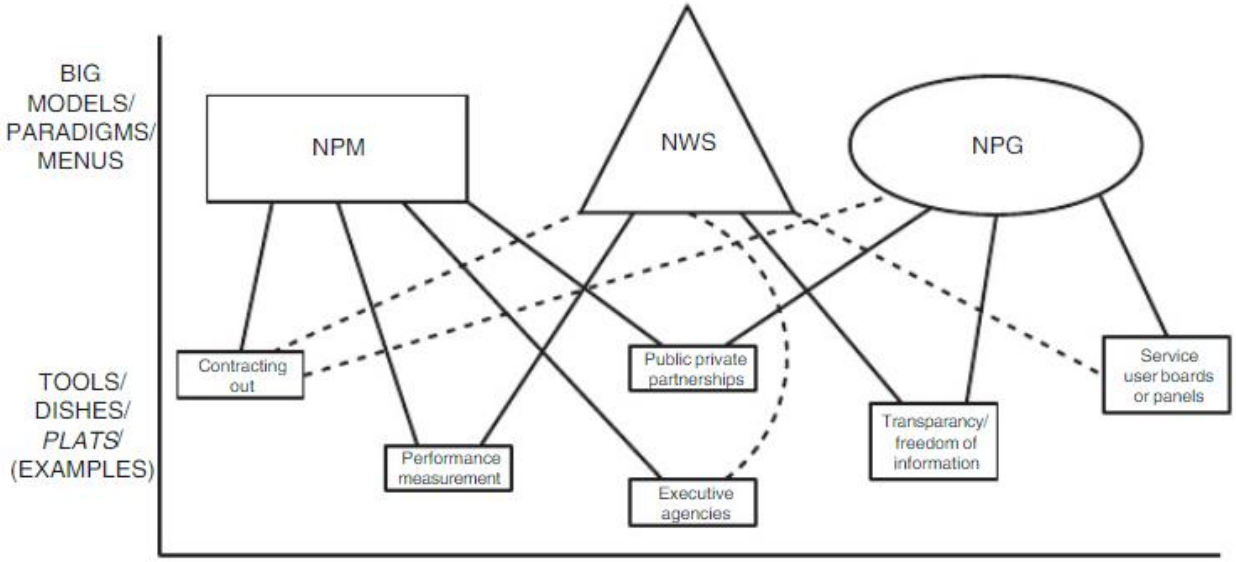
As the academic field of PA has evolved through the years, a variety of characteristics have been added to the discussion of what is governance and what is "Good Governance". A discourse that initially centred on quality and efficiency of the administrative body of the public sector as well as the technical routines and legalities of public organisations, has now developed into a set of characteristics on how to assess the public sector in general (Pollitt and Bouckaert 2011, 7). These characteristics of governance have come into focus during public reforms, as have different governance related issues appeared only after implementing policies from different frameworks.

In Classical Public Administration (CPA), policy making and implementation are vertically integrated in the public sector (Osbourne 2010, 8). CPA embodies a strong public sector, where accountability and stability are among core values. After the onset of welfare states, hierarchies were deemed too inefficient and market type mechanics were proposed as a solution to increase PA efficiency (Kostakis 2011, 146). The public sector adopted management practices from the private sector and organisations were reorganised. A core claim of NPM was to complement hierarchy via a system of accountability to customers (citizens), using mechanisms such as feedback forms, surveys and user panels (Homburg 2004, 549). NPM enjoyed widespread popularity and represented a mentality shift of the public sector. However, there is now widespread consensus that NPM as a framework has not succeeded (Osbourne 2010, 5; Drechsler 2004, 392; Randma-Liiv 2008, 12) despite being prescribed as a panacea for governance issues. First of all, NPM requires a strong bureaucracy to function, thus it failed to improve in countries where the public sector was already experiencing difficulties (Drechsler and Kattel 96 in Pollitt et al 2008). While NPM's effectiveness was supposed to stem from market-type practice, it created quasi-markets in the public sector, which did not provide the same results as actual markets (ibid. 98). The transition periods between different regimes is not clear cut, but becomes apparent after using new practices in PA (Dickinson 2016, 55). It is important to note that since NPM has been disregarded, not every public service has magically transformed itself away from being NPM-style. Reform has happened gradually and in reality, all of the PA regimes still co-exist, in one way or another (ibid, 46).

There is no consensus on what the "next big thing" is, as neither NWS nor NPG can be regarded as the definitive paradigm. Regardless, either one of them can be used as a conceptual tool to respond to public challenges and manage public service delivery (Osbourne 2010, 6). The prominent regime acts as a beacon to which policy ideas can be compared and from which public policy values can be derived. Currently, most governments utilise some form of hybrid governance framework consisting of elements from either theory, where elements of one framework are used to make up for weaknesses in another (Kljin and Koppenjan 2012, 13). Similar to NPM, a PA framework often functions best in a certain context. Both NWS and NPG focus on the capability of the state and in order to increase the public sector capability, the state must efficiently use all resources at their disposal, not only public sector resources (Raipa 2011, 113). One of the bigger differences between the two is how the state manages the resources of society. NWS takes a state centred approach, strengthening the core functions of administration and increasing administrative capacity. The "neo" part of NWS provokes a interesting question: does the "neo" part of NWS challenge the concept of trajectories and path-dependency (Lynn 2008, 5)? If NWS represents the state and hierarchy in an enlightened fashion, then there is some room for interpretation as to how it is put into practice. Furthermore, governance models tend to focus on one aspect of governance, omitting other important factors in the operating of the state (Pollitt et Bouckaert 2011, 209).

NPG among other post-NPM administration regimes provides new arguments and focal points. As argued previously, PA regimes co-evolve with society and economies — they are at the same time a product of and a response to the concurrent state of the public governance. The same can be said about NPG as it is a mirror of the "complex, plural and fragmented nature of public policy implementation and service delivery in the twenty-first century." (Osbourne 2010, 9). NPG's theory is grounded in networks and the public sector is the governor of those networks. The state can no longer be assumed to be the monopoly of expertise. A comparison of NWS and NPG reveals a distinction in the centres of interest. NWS focuses more on the internal capacities of PA as emphasised by the authority and disciplined hierarchy. Compared to NPM, there is definitive aspect of retaining authority within the public sector as means of using markets as supplementary coordination mechanisms. In this sense, NWS is more of a counter-thesis for NPM, a direct result of the shortcomings of NPM. Below is an image that demonstrates the different tools utilised by the frameworks.

Image 1. Tools of public administration models.



Source: (Pollitt and Bouckaert 2011, 22)

According to the image above, transparency (freedom of information) and service user panels are two tools, which have not been extensively used by NPM nor by CPA. These tools also demonstrate the extent of governance, as it reaches beyond the public sector, involving citizens as part of the operating of the public administration. The tools used is an indication of the coordination mechanisms utilised by the government. Verhoest et al (2005) define the scope of coordination on a macro level as "government governance", where coordination is the redistribution of tasks between the public sector and private/third sector, between different levels of government and the transformations of control, evaluation and guidance. Coordination is the alignment of tasks and efforts of multiple actors in order to reduce redundancy and increase policy cohesion (Verhoest et al 2005, 4). Coordination in public sector can either be vertical or hierarchical, coordination exists between the central authority and subordinates, and it can also exist between subordinates or actors without the central authorities' intervention (ibid.). Therefore, the form of coordination mechanism dictates the possible tools available to the state. Wanting to involve citizens or NGOs in implementing policies does not come without transferring some responsibility and therefore authority. Thus the discussion of benefits of different framework always boils down to the specifics, considering status quo, some tools may provide more benefits that other tools.

While NWS framework is more or less more of the same (the state as the centre), NPG is a newer approach. In a NPG framework, the public sector relies more on horizontal coordination, where the state facilitates coordination between different actors and perhaps lets coordination *happen* organically between actors without intervention, both with the aim to increase network actor collaboration and gain feedback and input from said actors. This results in the output of the political system, where the regime's output is no longer only consumable public services usually attributed to Weberian style management (Torfing et Triantafillou 2013, 15). Instead the output of the public administration grows into a complex web of tools and participation. In essence, coordination is the mechanism of how to "extract" value from society from a public sector perspective. This value for the government is not universally beneficial, but it may contain perspectives and initiatives, which do not align with the government's capabilities, hence why hierarchical coordination is effective, because it does not extract dissent. In the context of coordination mechanisms, blockchain governance is comparable to markets and hierarchies in the sense that none of them is universal: markets provide flexibility but have shown to reduce people to numbers, hierarchies are accountable but rigid, and blockchain is flexible and pluralistic but the least accountable of them all. It has been argued that NWS as a form of governance would be too rigid for today's society and to balance NWS' top-down management.

Networks theory provides an alternative coordination mechanic compared to markets and hierarchy (Dickinson 2016, 45). Networks can be viewed as a mechanism to unite different values. New solutions need to be generated to unite different values and those solutions are based on the creativity of the network. Subsequently, in order for a network to be useful, it has to generate innovative solutions based on the combined information and resources of different network actors. However, from an individual perspective (in the network), sharing resources and knowledge is risky, because none of the individuals can predict the outcome, nor which solution is picked (Osbourne 2010, 308). The nature of network governance presents several challenges such as collective decision-making, strategic games and risk-taking. Trust becomes a central part in the functioning of the networks since the participants might have opposing views on the nature of the problem, as well as what values are applicable and how the solution should be formed (Osbourne 2010, 309). Trust embodies vulnerability, risk and expectations. Having trust means that one leaves oneself in a vulnerable position and expects no opportunistic behaviour from the other actor — having trust means actors take

others' interests into consideration (Klijn et al 2010, 3). Network theory is not only essential in the discussion of NPG, but it provides wider context on how multi-actor communications takes place.

In conclusion, frameworks utilise tools to achieve certain goals. They may use the same tools, such as NPG and NWS both valuing transparency as a tool to increase legitimacy towards the citizens. Some socio-economical advancements are also used as policy tools, namely the internet. The internet was initially developed for other purposes, but now it has grown it a global platform. Within the context of PA frameworks, e-government and e-governance has grown out of the adoption of the internet.

1.3. E-governance

During the NPM paradigm, bureaucracy almost became curse word, expressing a slow and monolithic state (Homburg 2004, 544). The state had a strong pressure to improve its services and reduce the administrative burden for citizens. Many of the NPM policies resulted in the surge of e-governance solutions, in efforts to increase public sector efficiency and decrease administrative costs. As e-governance has been implemented globally for more than a decade now, it has mostly been successful in increasing the governmental capacity (Torres et al. 2005; Potnis 2010 referred in Xia 2017, 1). In the discussion of e-governance, sometimes the term e-government is used interchangeable, albeit those concepts encompassing different aspects of using IT technology for the betterment of society and the public sector. On a conceptual level, e-governance refers to innovative **management processes** and e-government refers to using innovative **practices** in the public sector (Broucker et Crompvoets 2014, 4). Similar to NPM and post-NPM frameworks, the driving force behind e-government has been linked to the goal of reducing administrative costs (Bernhard 2014, 20). The distinction between the two implies a politico-ideological difference: e-government relating to the reduction of costs and efficiency, e-governance relating to the improvement of e-Services from the citizens perspective. E-governance can be understood as "the use of the technologies that both help governing and have to be governed" (Rossel et Finger 2007). In general, the concept of e-governance can be divided into two separate aspects: open governance and e-participation (Xia 2017, 1). Open governance refers to the concept where the public has access to non-confidential governmental information and this information can be used by civil society and by entrepreneurs. the flipside, e-

government is a more focused, institutional approach of IT-based governmental services for citizens (Sheridan et Riley 2010).

E-governance is more relevant in the context of this thesis, as e-government transformed from a efficiency tool within the NPM framework to a broader concept of e-governance linked with NPG. Simple and hassle-free communication with the state has become a common expectation for the citizen (Markushewski et al 2016, 1). In addition, with the onset of e-governance policies, the focus of public value has shifted to how public value is created in the first place. IT solutions have opened up both society and the government as to how they can interact with society as a whole. The future is less and less the construct of only the government (Broucker et Crompvoets 2014, 5). In conclusion, e-governance has become a defining concept in today's public administration, as it embraces the ideas of both faster and better public services and the idea of e-participation, civilian inclusion. Blockchain will solidify its roots in e-governance, becoming a core technology for e-voting among other uses.

1.4. Blockchain

In 2008 the world experienced a financial crisis during which millions of people lost their life savings as trillions of dollars were used to save major US banks due to their systemic corruption and lack of risk management (Coffin 2009, 4). Roughly at the same time a white paper about a cryptocurrency called “Bitcoin” was released by a pseudonymous programmer Satoshi Nakamoto. The white paper introduced the concept of digital cash in technical detail, promising to conduct low-fee digital transactions without trusted intermediaries (Nakamoto 2008, 1). Even though digital cash and a cryptographically secured chain of “blocks” were not new ideas, the white paper stated a solution for the Byzantine Generals’ Problem[3] by implementing a Proof-of-Work consensus protocol. Nakamoto’s vision was not to overthrow the government and start a financial revolution, but rather to provide services to those that are not currently served (Tapscott and Tapscott 2016), specifically third world

[3] The Byzantine Generals’ Problem: Multiple generals are surrounding a city and they need to have a consensus on whether to attack or retreat. However, each general can only use one messenger to communicate with others and there might be a traitor among the generals. To problem arises from how to relay the same message to all participants and identify the traitor.

countries where many institutions were slow and governments corrupt. This new technology provided the citizens a trustworthy system that is outside the current realm of governments.

Blockchain is distributed ledger, a constantly growing chain of blocks, which house (transaction) data. Those blocks are cryptographically secured and have timestamps, as a result, each block is linked to the previous one (Martindale 2018). The blockchain is distributed between nodes (participants of the blockchain) and whenever a new block is validated, it is immediately added to all of the nodes (Bauerle). At its core, the aim of blockchain is to resolve the problem of trust during transactions between parties. When traditionally there has been a third-party trusted organisation, be that a government or bank, blockchain removes the need for a middle-man with a peer-to-peer network. A number of transactions are bundled together in a new block which will be added to the blockchain. When a new participant enters the blockchain network, they adopt the longest chain which is considered to be the most valid (Mazonka 2016, 3). Therefore, there is no single point of failure, meaning no single node can rewrite the blockchain or validate fraudulent transactions and if a single node is destroyed, the network is still functional. Even though bitcoin and blockchain were under the radar for many years, many factors have contributed to their recent prominence. The first blockchain based application Bitcoin has multiple advantages over their traditional non-blockchain counterparts, which is one of the reasons why the technology has gained popularity in the last years. An additional reason why public blockchains such as Bitcoin generate publicity is due to the fact of higher mistrust in current forms of government and institutions. Blockchain technology promises a new form of governance and challenges the conventional hierarchical governance models via trustless decentralization, hence why blockchain has a lot of support from liberals and socio-anarchists.

On a conceptual level, blockchain allows two parties to legitimately transact with each other without the need for a third party authority. Traditionally, a legitimate transaction requires an intermediary who governs the transaction, making sure that both parties uphold their end of the transaction. The government has traditionally outsourced this intermediary role for example banks or law firms, who are held responsible in case of misconduct. Utilising blockchain governance raises an important question in regards to the management of the network: who carries responsibility in a complete decentralised network without a central authority? The anonymity and decentralisation aspects make blockchain and the internet rather similar. Blockchain is often compared to the internet in the context

of technological innovation (Iansiti and Lakhani 2017), but they have a key significant difference. The internet is a fundamentally technological innovation, while blockchain can be argued to be a fundamentally institutional innovation (Davidson et al 2016, 15). Blockchain does not make electrons move faster, however, it does reduce transaction costs by eliminating opportunism by cryptographic mechanisms (ibid.). In this perspective, blockchain is a foundational technology for new forms of governance (Davidson et al 2015, 3). That is to say that blockchains compete in markets with organisations as institutional alternatives for coordinating the economic actions of people (ibid.). As part of reform frameworks, the question lies whether blockchain, the question arises whether blockchain provides most benefit as implemented simply as a technological solution or adopted more deeply as a separate form of governance. The next chapters give an overview of the main aspects of blockchain, which relate to reform frameworks and more importantly, to e-governance.

1.4.1. Decentralization and Immutability

Conceptually there are few boundaries for the use of blockchain as it could provide benefit in any field, which relies on bookkeeping or databases, which need be modified or accessed by multiple actors. The core concept of blockchain is perhaps simple, but the specifics of a blockchain network determine its use in the markets or in the public sector. The two principal characteristics of blockchain technology is the distribution of nodes and the immutability of the blockchain. Cryptocurrency has been the first widespread use case of blockchain technology, therefore many do not recognize that at its core, blockchain (and Bitcoin) is about decentralizing trust. In a traditional society, trust is centralized in the government through laws and law enforcement. Having a centralised organisation means data, knowledge or resources are vested in a single unit. A centralised system or organisation provides a risk where if the functioning of the central authority is not optimal, than the functioning of the whole system is negatively affected by it - also known as Single Point of Failure (Atzori 2015, 4). Blockchain based applications fix this issue by distributing what is “central”.

Having the blockchain ledger distributed between all network participants, changing past blocks in the blockchain is practically impossible and the longer the chain grows, the more resource intensive and less realistic it is to hack the system and modify all past blocks — once something is printed on the blockchain, it stays there forever. Each block in the blockchain has a hash that is made up from the contents of the block and this hash is referred to by the following block. This provides another

layer of security and transparency, allows actors in the blockchain network to confirm, validate and check transactions. In the case of public blockchains, past transactions can be audited without issues through browser based blockchain explorer, because each transaction has a transaction hash, which acts like an ID. While some characteristics of the blockchain (such as public or private access) may vary, immutability is the core principle what makes blockchain unique (Ollerus and Zhegu 2016, 234). Although blockchains are conceptually immutable, the main consensus protocols such as Proof-of-Work and Proof-of-Stake protocols have a theoretical risk called the "51% risk" - 51% of the blockchain network actors unite against the remaining 49%, by computational power or by vote count having the possibility to choose which blocks are valid and thus generate illegitimate transactions. However, by modern computational requirements, blockchains offer a high degree of security, only threatened by quantum computers.

1.4.2. Public versus Private

The distinction between public (or *permissionless, open*) and private (or *permissioned*) blockchains is critical to understanding implications of its public sector use. Discussions about blockchain often fail to make distinctions between access types and even though both types are still blockchain, the access type determines the use case. While both types share the main blockchain characteristics, private blockchains are primarily important because of the reduction of transaction costs while public blockchains have the added aspect of decentralized governance. Private blockchains are more akin to advanced data tables while public blockchains allow decentralized governance.

A private blockchain requires an invitation to participate in the blockchain network and that invitation must be validated by the administrator (Jayachandran 2017). The existing users of private blockchains have control over who can join the private and in addition, control who participates in the consensus process of the blockchain (Greenspan 2015). A private blockchain in that sense is an alternative method of managing databases, having both strengths and weaknesses over managing databases centrally (ibid). Moreover, private blockchains often do not have tokens as opposed to a permissionless blockchains. Public blockchains are in the focus of the discussion of blockchains in media. A public blockchain is a blockchain, where actors can enter and participate in the blockchain without having to get permission by existing users. Anyone with an internet connection can participate in Bitcoin or Ethereum blockchain, make transactions and also participate in the consensus process.

Public blockchains introduce a governance issue - how is consensus achieved in a system of (hundreds) thousands of participants? While private blockchains also have the questions of how consensus is achieved, they can rely on a trust model based of the authority of trusted peers (Martinovic et al 2017, 6).

1.5. Synthesis

PA frameworks are used to define Good Governance, forming a "compass" for public reform. The theoretical framework established NWS and NPG as the contemporary PA frameworks. Both are the result of NPM policies and a reaction to modern governance problems. NWS approaches PA from a back-to-the-roots centralised governance approach with the focus on increasing the capabilities of the state apparatus. NPG on the other hand emphasises network governance as the key model for increasing state's effectiveness. Moreover, it was discussed that these frameworks exist simultaneously as their boundaries are often vague. This understanding is reflected in the academic discussion of PA, where these governance models have been defined first as paradigms, regimes and later trajectories. Correlating frameworks with blockchain initiatives does not prove any definitive patterns, however comparison may provide input and context as to how blockchain benefits public administration.

The theoretical framework of the thesis relies on three layers: reform frameworks, e-governance and blockchain. From a bottom up approach, they are all connected as blockchain in the context of public administration is part of e-governance, which is a tool for contemporary PA frameworks. To answer the research questions raised within the scope of this thesis, the characteristics of blockchain are reflected to PA frameworks through the lens of e-governance. The characteristics of blockchain reflect how it can be used within the public sector and reversely, what are the governance implications of different types of blockchains. Governance frameworks can be argued to have some form of predictability depending in which context they are used (Pollitt et Bouckaert 2011, 219). The same type of logic could be applied to blockchain implications within governance frameworks as results can be drawn for a specific case. To sum up, e-Governance specifies **what** are the uses for blockchain in the context of public administration (i.e. voting, open-data-government, collaboration) and reform

frameworks add the context of **why** blockchain is or could be used (i.e. increasing public sector efficiency or increasing legitimacy). The case of Estonia illustrates the reform trajectories for this thesis.

2. Estonian Case Study

Estonia is one of the more active countries in utilising blockchain in the public sector. For long it has been an avant-garde state in terms of IT used in the public sector - from ID-cards to electronic voting and now experimenting with e-residency. Already in year 2000, the Estonian parliament passed the Digital Signature Act, which made digital signatures legally binding, similarly to hand-written ones (Martinovic et al 2017, 8). Estonia has historically experienced high social trust toward IT solutions (Lember et al 2016, 4) and coupled with a progressive attitude towards western policies, the country has achieved remarkable growth since its re-independence. Nowadays, IT is a focal point in the functioning of the Estonian public administration. With the e-Residency project, the country aims to market its IT capabilities and expand its IT infrastructure exports. Although blockchain and cryptocurrencies are relevant in the case of e-Residency, the project itself has very little substance for empirical input. However, the X-Road, the core IT system for the Estonian state, is among the first widespread blockchain systems for PA use.

From a methodological standpoint, we focus on the blockchain project in Estonia in general, as a single blockchain project such as X-Road is too narrow to provide input for PA discussion. Including multiple projects and organisations, a trajectory may appear as to how Estonia manages e-governance. As discussed in the theoretical part, it is impossible to directly pinpoint Estonia within a single PA framework. However, the interviews below reflect some trajectories, management practices and routines, which allow Estonia to be categorised within certain frameworks more than others. This provides insight to what can be expected from future use of blockchain within the Estonian public administration.

2.1. Research Methodology

This research is a qualitative research, a case studying focusing on Estonia. Since there are only a few other academic studies bridging blockchain and the public sector, this thesis took an explorative approach. Qualitative methods, namely document analysis and interviews were chosen as they align with the wider narrative of the thesis to provide explorative discussion, rather than have definitive

conclusions (Rajasekar et al 2013, 9). Due to the explorative nature of this thesis, there are no hypothesis that will be validated. Rather, the empirical results will be used to provide explanation to the research questions.

Using Estonia for case study analysis has several benefits. First of all, Estonia has been using blockchain for many years, providing empirical evidence for the performance of the X-Road blockchain. Estonian regulatory framework has coerced organisations into adopting e-government services, highlighting obstacles and weaknesses. In addition, Estonian path dependency of utilising technology has grown its roots in many public sector organisations, demonstrating how the governance aspect has evolved through the years. Lastly, Estonia has transparency regarding the performance of X-Road, ample data gathered via blockchain and future plans. Considering the academic novelty of blockchain governance, Estonia provides more empirical evidence than most of its peer countries. There are several reasons for the selection of organisations. Currently, none of the organisations utilise individual blockchain solution, but they rely on the X-Road. Organisations from different fields were selected: social welfare, healthcare and the environmental sector. In addition, each of these organisations deals with a large amount of data and contracts. The Environmental board issues thousands of permits per week, Health Insurance Fund requests hundreds of health related queries per day. Two additional organisations in the environmental administrative area have been included to provide a wider context. In addition, as Health Insurance Fund and Unemployment Insurance Fund operate as autonomous organisations, the Environmental Board works very closely with the Ministry of the Environment and the Information Technology Centre of the Ministry of the Environment. Lastly, all of the aforementioned organisations heavily rely on IT to provide services.

Research data has been gathered via semi-structured interviews with public sector workers. A semi-structured interview approach was selected with the aim was to gain insight into how technology has governance. The interviews were split into two general parts. The first part of the interview focused on the interviewee and their organisation. The goal was to understand how the organisation is managed and how is it positioned in the public sector, which other organisations it cooperates with and reports to. The second part of the interview focused on the future possibilities of technology within the scope of that organisation and whether blockchain specifically is seen as part of it. Understanding future plans provides broader perspective towards reform trajectories.

Each of the interview below (excluding X-Road chapter) is structured similarly. The first paragraph gives an overview of the organisation and why it is important in the context of this research. The second paragraph outlines key thoughts and insight from the interview, focusing on IT services and governance related affairs. The third paragraph provides an organisation-specific synthesis. At the end of the empirical part, a general overview of the interviews is provided alongside main conclusions. The discussion part relies on these conclusions and discusses them in a wider context.

2.2. X-Road

The Estonian X-Road is an open source data exchange layer solution which provides a secure way of governmental and non-governmental organisations to provide and consume services (Riigi Infosüsteemide Amet 2015). It is one of the first large scale governmental applications for blockchain technology in general, serving as one of the core technologies of e-governance in Estonia. In the scope of this thesis, X-Road is relevant as it spans dozens of organisations and each ministry, office or institution interacts differently with it. Organisations can become part of the X-Road if they meet the requirements of the X-Road regulation (Riigi Infosüsteemide Amet 2015). In Estonia, over 900 organisations use X-Road daily and more than 52 thousand organisations use it indirectly[4]. The data exchange layer has also been set up in Finland, Azerbaijan, Namibia and Faroe Islands. Estonia and Finland have concluded an additional agreement, where data can automatically shared between countries[5].

Today, Estonia is glorified with an efficient e-government, where almost all government services are accessible online (Veebel 2018). I-Voting participation rates are in the double digits, tax filing takes only several minutes and much of citizen-to-government interaction is digitalised. All of the digital evolution can be attributed to Estonia's *tiger leap* in the late 90s, after being separated from the Soviet Union. The Estonian digital infrastructure relies on multiple key concepts such as ID cards and X-Road, which all work in union to allow internet access to delicate data. The X-Road project was

[4] X-tee faktileht, https://www.ria.ee/x-tee/fact/
[5] X-road, https://e-estonia.com/solutions/interoperability-services/x-road/

already launched in the 1990's to create a secure and standardized platform for allowing public sector organisations to exchange data safely and quickly. The focus of the X-Road was to build a core infrastructure that allows interoperability between registries while maintaining security and allowing for organic integration with existing systems.

The X-Road is based on Cybernetica's Unified exchange Platform and uses Guardtime Keyless Signature Infrastructure for security[6]. It is used by nearly all major Estonian public service organisations that deal with citizen's data. However the Estonian X-Road is not really secured via a true blockchain, but rather a Merkle tree, which is part of the blockchain logic (Gerard 2017) and the X-Road has not shown to change the way public services are delivered (Tõnurist et al 2016, 21). The main purpose for the X-Road has been to provide the state an efficient and secure way to manage citizen data.

2.3. Ministry of the Environment

The aim of the Ministry of the Environment (hereinafter shortened MOE) is to balance the development of the economy, society and environmental protection[7]. MOE was chosen for analysis because at this point, there are few blockchain use cases in the environmental sector, compared to finance, business and healthcare which more extensively rely on X-Road. Regardless, the environmental sector handles a large amount of data regarding monitoring, fishing-hunting permits and wastage (Keskkonnaministeerium 2017, 2). That data is modified and utilized by multiple governmental, business and non-profit organisations. The interviewee from the Estonian MOE is from the internal audit department. The role of the internal audit department of the MOE reviews and gives feedback on the internal processes of the organisations in the administrative area of the MOE. This department was chosen to gauge scalability of blockchain technology, whether blockchain provides benefit on a supra-organisational level (similar to the X-Road which covers numerous organisation) or blockchain can be implemented in a specific manner, tailored for intra-organisational functions. The head of the Internal Audit Department was interview for this thesis.

[6] Ksi Blockchain, https://e-estonia.com/solutions/security-and-safety/ksi-blockchain/
[7] Keskkonnaministeeriumi põhimäärus, RT I, 06.03.2018, 13

The interview provided insight into how technology and specifically the X-Road indirectly change organisational routines. As the interviewee expressed, MOE does not directly interact with the X-Road on a day to day basis, as the organisation is a legislative organisation, they are less exposed to X-Road services compared to subordinate organisations. MOE representative emphasised how from an auditing standpoint, technology shifts risks from one procedure to another. They explained that as additional routines are automated, human input becomes increasingly important. The representative illustrated, that from a general perspective, blockchain caters to the concept of auditability, as transparency and bookkeeping are blockchain's value propositions. In the interviewee's opinion, blockchain could be implemented in a way, which extends the current scope of the technology in the case of Estonia.

The work of internal auditors is tightly regulated in Estonia, as they have quality standards to analysing public sector processes. Internal auditors only give feedback, they do not have any enforcement power, and their only aim is to improve existing processes. Technological solutions do not have a significant impact on how the auditors conduct their work, rather technology changes how they approach auditing objects (organisations or departments they analyse). From an administrative capability perspective, there is increased pressure on servants to be able to properly use the systems, carrying the added notion of systematic risk. Blockchain technology most probably caters more towards a NWS framework compared to NPG from an auditing standpoint, as blockchain may increase the legitimacy through technological means.

2.4. Information Technology Centre of the Ministry of the Environment

The Information Technology Centre of the Ministry of the Environment (hereinafter KEMIT as shortened in Estonian) was chosen as one of the organisations for the analytical part of this thesis because of its functions, managing IT solutions for inter-connected organisations. The managing director of KEMIT was interviewed with the aim to gain insight into how the technological solutions is managed, what provides basis for implementing technological solutions and how the administrative area governance impacts the technological capabilities. The other focus was to discern how blockchain

is perceived in such an organisations and if the organisations sees any practical value in implementing blockchain solutions in the organisation. If sector-wide blockchain projects were launched in the environmental administrative area, KEMIT would be one of the organisation designing and developing such projects. KEMIT is an IT centre in the administrative area of the Ministry of Environment. KEMIT provides support and develops IT services only for the institutions in the same administrative area[8]. Their services are broadly categorised into business services for state owned enterprises, general function IT services for the administrative area and monitoring services. KEMIT is a new institution, founded in 2013 as means to centralize IT services in the environmental administrative area[9]. The main reason for a centralised service centre was to reduce upkeep costs, as smaller organisations in the administrative area did not need a specialised IT department, thus all IT departments were forged into a centralised service centre. The interview was conducted with the director of KEMIT.

The representative of KEMIT explained the core routines of the organisation and how the organisation cooperates with other organisations in the administrative area. They focused on the fact that KEMIT collects input for developing new services from other organisations in the administrative area and additionally updates existing services to match regulatory changes, thus, the core task besides managing the IT development is also managing projects. According to the interviewee, the biggest obstacle for KEMIT is the lack of resources aside from money, especially specialists. In the perspective of the representative, there is a lack of project managers which causes KEMIT to spend too many resources on filtering out projects which are either overlapping with each other or which lack a definite need. To the question of why new IT solutions are adopted, the interviewee responded that similar to other IT based service centres, the push for innovation in KEMIT is based on societal needs and general innovation. Cloud-based IT and Internet-of-Things are currently the biggest upcoming IT developments in their opinion. Blockchain, however is not on their agenda of new technological advancements, because of the lack of a clear use case of blockchain in the Ministry of Environment administrative area and in KEMIT itself.

[8] Keskkonnaministeeriumi Infotehnoloogiakeskus, https://www.kemit.ee/
[9] Keskkonnaministeeriumi Infotehnoloogiakeskuse põhimäärus, RT I, 09.03.2018, 23

KEMIT as an organisation falls within the NWS framework, as it follows the wider Estonian initiative to centralise administrative area IT capacities within one organisation. In this context, it is important to understand that KEMIT has a supportive role, as it does not develop policies nor service civilians, it only services other public sector organisations. Therefore, IT capacities are kept within the public sector as only smaller projects and developments are outsourced to the private sector. The biggest network for KEMIT is the organisation which give their input for IT developments. As mentioned by the KEMIT interviewee, managing input requires resources but blockchain will probably not alleviate such a situation.

2.5. Environmental Board

Environmental Board (hereinafter shortened as EB) is an executive organisation within the environmental administrative area[10]. EB implements state policies regarding the use of the environment, nature conservation and they contribute to the development and improvement of regulation[11]. They are responsible for oversight of a large variety of environmental sectors, from forestry, waste management, fishing and others (Keskkonnaamet 2016, 4). On a daily basis, they cooperate with NGOs, other public sector organisation and provide input for the Ministry of Environment for policy development. EB is an important organisations in the context of this thesis, as it conducts a lot of transactions based on several environmental monitoring databases. They current system is based on older IT frameworks and each database is separate as a silo from other databases. In this context, blockchain could provide benefits from both e-government and e-governance perspective.

The interviewee focused on how IT is used to combat the increased public pressure to have lower administration costs and at the same time increase the quality of the services provided by EB. In addition, the EB representative mentioned that environmental sector falls outside the political priorities, in a context where aging population for increases pressure to optimise costs, thus reducing the available resources for the organisation. While increasing organisational efficiency is a default

[10] Keskkonnaameti põhimäärus, RT I, 26.02.2018, 4
[11] Keskkonnaameti tutvustus, https://www.keskkonnaamet.ee/et/keskkonnaamet-kontakt/keskkonnaameti-tutvustus

method of coping governmental and administrative area trends, the interviewee outlined two additional methods of managing resources. The first method is mapping all of the services provided by EB and deciding whether they have the resource to provide these services. Services with fewer users and less of an environmental risk have the highest probability of being terminated in upcoming years. Simultaneously, their second method relies on being able to digitize the services, most importantly the procedural operations. If technology allows them two minimise costs, the service can be provided sustainably. In the perspective of the interviewee, a large part of the digitalisation depends on having up-to-date underlying IT systems. Their current systems are old, having security risks and providing a subpar user experience. The interviewee referenced their current IT projects named "KOTKAS 2" to be a huge step forward, but still lacklustre in the grand scheme of things. In order to maximise the benefits of technology, in their opinion they need to cooperate with related organisations and they have to be able to maintain unified databases, meaning the client does not have to apply for multiple permits, but rather has a single complex permit. While EB has a project called "Kliendikoda" which aims to gather feedback from clients and improve services based on that feedback, their main motivation for implementing and updating IT systems and services is to increase efficiency.

The case of EB draws attention to an important factor in the context of utilising IT services. While the reform frameworks more or less describe ideal conditions, they do not focus on the specific details. In the case of EB, the organisational culture is moving towards a more horizontal approach, but the IT systems are developed mainly for efficiency gains. The disparity is due to funding issues. EB sees potential in e-governance, but they do not have resources to improve their services based on e-governance principles. In addition, the case demonstrates the importance of initial system design, as their older IT systems have become a technological burden, often limiting their activities.

2.6. Health Insurance Fund

Estonian health care is carried out by a multitude of organisations, the largest being the Ministry of Social Affairs, Agency of Medicines, Health Board and Estonian Health Insurance Fund (hereinafter EHIF). EHIF falls under the Ministry of Social Affairs administrative area, being responsible for

complementary health insurance, healthcare benefits, services and digital prescription[12]. The digital health files are the most queried services in the administrative area[13], making EHIF one of the biggest X-Road user in the administrative area. In regards to IT systems, EHIF aims to create a unified database of *Tervise Infosüsteem* (translated as Health IT System) for increasing efficiency and cooperation with other organisations (Eesti Haigekassa 2017, 27). Estonian healthcare is almost completely decentralised, as health care service can be provided by public and by private organisations[14]. EHIF also cooperates with around 3000 different actors in Estonia, ranging from private entities supplying medical equipment to pharmacies and associations (ibid.). Many of the main activities of EHIF consist of managing of health insurance, maintaining databases for health insurance benefits, examining the services of various health services and participating in health care policy (ibid). The interview was carried out with the chairman of the board of EHIF.

The interview offered insight into how EHIF is utilising technology to mitigate the effects of an aging population. According to the interviewee, the current healthcare system in Estonia is based on solidarity, meaning all working people contribute to healthcare via taxes. As the population ages, the amount of people paying taxes reduces, directly impacting social welfare. For EHIF this requires substantial changes in order to offer healthcare sustainably. Alongside increasing operational efficiency and improving the quality of services, the interviewee focused on two main paths for EHIF. The first path is related to increasing cooperation within the healthcare sector. The underlying issue is that population is dispersed around the country, but people in the capital and in the farthest corner in Estonia need the same amount personnel to be treated. For example, in a case of a birth, there are several doctors needed to safely finish the procedure. The representative point out that smaller hospitals may not have the budgetary means to have several doctors on stand-by, while they have only a handful procedures a year. To counter this, the representative discussed the idea of neighbouring hospitals increasing cooperation, have a flexible workforce, which however requires profound technological systems to efficiently manage the system. This leads to the second main path for EHIF - IT services. According to the interviewee, machine learning is seen as the biggest technological advancement in the near future — it could replace mundane processes that currently humans have to

[12] Eesti Haigekassa põhikiri, RT I, 29.12.2017, 34
[13] X-tee teenuseid osutavate asutuste ja infosüsteemide nimekiri, https://www.mkm.ee/sites/default/files/x-tee_teenuseid_osutavate_asutuste_ja_infosusteemide_nimekiri.pdf
[14] Eesti Haigekassa, https://www.haigekassa.ee/haigekassa

do. In the interviewee's perspective, utilising machine learning and automation, they are able to free up human resources and utilise them in aspects which machines are not able to.

Estonian healthcare relies on a large network of actors, thus it not strictly fit within the NWS framework, as input is also gathered from private entities and NGOs. In the NWS framework, business practices only have a subsidiary role, however in the case of Estonian healthcare, private entities make up a large portion of the market. In such a case where there are a variety of actors with often competing interests, blockchain could provide benefit and already does in Estonia. EHIF is planning on extending their e-service platform with e-consultation and nationwide patient databases. Blockchain immutability could reduce accountability and auditing costs for EHIF, as guaranteeing the safety of medical equipment is one of their core tasks. Regardless, due to budgetary restrictions, machine learning is seen as the prominent IT tool in the near future. Using concentrated data as a result of machine learning, EHIF can make knowledge-based decisions.

2.7. Unemployment Insurance Fund

The Estonian Unemployment Insurance Fund (hereinafter referred as Töötukassa which is its legal name) administers social insurance related to unemployment and provides labour market services to help the unemployed[15]. The organisation that operates independently from the government, but has its goals determined by the law[16]. Töötukassa has been an active organisation in utilising e-services to increasing its organisational effectiveness and provide additional public services. The organisation has set its goals to improve their IT systems' functionality and user experience (Eesti Töötukassa 2017, 7). As an autonomous organisation, Töötukassa has the ability to coordinate its own methods and activities, compared to other public sector organisations. The interviewee from Töötukassa is a member of the board.

The interview with Töötukassa representative provided insight into how IT provides value to the organisation. According to the interview, Töötukassa has focused on developing IT solutions to

[15] Eesti Töötukassa Põhikiri, RT I, 31.05.2017, 12
[16] Eesti Töötukassa, https://www.tootukassa.ee/content/tootukassast

increase the efficiency of the organisation from the early days and even their future developments regarding e-government are based on the aim to increase the quality and amount of services. Based on the interview, even though their development plan refers to the unemployed as clients, they see the whole Töötukassa network (all actors included in their activities from local governments to entrepreneurs) as being a horizontal relationship between the stakeholders. The representative emphasised that such a horizontal communication is similar to the management of Töötukassa, known as "3-way management" where Töötukassa, the state and the private sector are all represented in management processes. From an IT-perspective, the interviewee discussed that the organisation has been utilising IT solutions from the start, the first solutions being the processing of unemployment financial support processing. The interviewee asserted that their reasoning for using IT services has always been based on two aspects: following the general trend of the "invisible state", where IT services are intuitive and the other aspect being the use of data to develop services. According to the representative, such data driven service enhancements are the reason why Töötukassa sees big data as one of their bigger trends and advancements in the upcoming years.

Like other Estonian organisations, Töötukassa follows the general public administration trends of increasing the competences of its workers, enhancing services and providing more professional support. Moreover, the organisation has a large network of governmental and non-governmental organisations and institutions that often are considered as partners as well as clients of Töötukassa. Therefore, Töötukassa presents a variety of governance trajectories from the NPG framework. However, their reasoning for the use of IT and other technologies is not based on pluralistic value, but rather it lies in the concept of advancing the public sector and its services from within the public sector, as opposed to with actors outside the public sector.

2.8. Synthesis

Empirical data was gathered with qualitative methods, mainly interviews and additionally document analysis for supportive input. The selected case is Estonia, as it is one of the leading countries in terms of blockchain adoption in the public sector. Interviews were done with public servants in the managerial positions in order to understand the wider context of e-government adoption and

developments. The results of the interviews demonstrate the relation between governance, IT and blockchain in the Estonian scenario. E-government is an important aim for all of the organisations. Most notably, none of the interviews showed any indirect interest in blockchain. Even though blockchain constitutes as the core technology in Estonian e-government, organisations did not envision specific use cases for blockchain use within that organisation. However, many of the problems presented by representatives seem to be curable by blockchain — on paper.

Judging by the results of the interviews, Estonian public sector steers more towards NWS style governance. The main focus of utilising IT is to increase inner-organisational capabilities: reducing administrative costs and automating basic processes. There is a significant element of user feedback and satisfaction to all of the organisations interviewed, but that type of feedback seems to be more akin to NWS compared to NPG. User feedback is not necessarily achieved by directly catering to the citizens, but rather with the creation of a professional culture of quality and service. The second biggest element of a NWS framework is the professionalization, where the public servant is not only a bureaucrat, but a manager of citizens' needs (Lynn 2008, 11). This is apparent from the changes of hiring policies of Health Insurance Fund, Unemployment Insurance Fund and the Environmental board. As an additional mean to meeting budgetary and quality goals, the aforementioned organisations not only use IT, but focus on having a professional workforce.

Analysing the overall responses of the interviewees, Estonian public sector organisations seem to have a concrete trajectory towards using IT to improve organisational efficiency, compared to other goals such as involving citizens or extending the scope of services. Tool in the sense that throughout all interviews, IT services were seen as a critical part to reducing administrative costs and making services more efficient. Moreover, IT has allowed to automate multiple tasks, reducing administrative costs. Another major implication from the interviews is that there is a disparity between executive and non-executive organisations. Non-executive organisation such as MOE focuses less on the efficiency gains compared to executive organisations. There seems to be a disparity between the demand of blockchain type solutions and the organisational technological issues. Even though most of the organisations interviewed demonstrated issues regarding data fragmentation and the need for unified data platforms, which private blockchains could do, the organisations themselves focused on other technological advances, mainly machine learning.

3. Discussion

Many private corporations and governments are experimenting with blockchain on a large scale with projects spanning several industries (Nussbaum 2017). The first blockchain project Bitcoin is now known globally and other projects are following suit. By rough estimates, the Bitcoin computational network is 10,000 times bigger than the top 500 supercomputers (Ehrsam 2017). Alongside Bitcoin, hundreds of projects have appeared, developing blockchain in every possible industry. Moreover, current academic literatures presents a consensus that blockchain is a revolutionary technology (Davidson et al 2016 23; Atzori 2015, 31, 56; Woodside et al 72, 2017, Wright et Filippi 2015, 56), transforming society on the scale of what the internet did. Every major technological advancement brings about bold predictions on how the newly discovered technological solutions will revolutionize society, even though many of these predictions have not yet realised (Bretschneider and Mergel 2011, 187). This type of explosive innovation happened during the dotcom boom, but this time society envisions a globally connected world (Whitworth 2009, 398). This advantage means that the adoption of blockchain could be smoother and more precise.

With that said, blockchain is facing a variety of obstacles ranging from scalability to governance issues (Pazaitis et al 2017, 26). From a PA perspective, public blockchains have the issue of accountability, because fundamentally, blockchain does not solve governance (Lehdonvirta 2016). Many blockchain proponents accompany blockchains legitimacy with the facts that in a blockchain network, "code is law", thereby reducing human-centred security risks. However, the underlying code still originates from developers, who need to take social norms and values into account when developing blockchain technology (Whitworth 2009, 399). The socio-anarchist view, that replacing white collar CEOs with developers equals giving power to the people, is conceptually wrong, because the (coding) power is still concentrated in a select group people. So in essence, at one hand it is a technology which is already considered important at this early stage, but at the other hand, it accompanies several challenges. Focusing the discussion on how blockchain provides benefit may help to resolve those issues.

This thesis set out to answer the question: how could blockchain technology benefit public administration in the context of reform frameworks? While several methods have been described, an

exhaustive list has not been composed. To better answer the main research question in the conclusion of the thesis, each of the sub questions is described below in-depth.

3.1. Blockchain in Reform Frameworks

Blockchain is at the same time a general purpose technology as well as a new form of coordination. Both of those aspects more or less apply to a specific type of blockchain: the reduction of transaction costs is more likely achieved through private blockchains as a general technology and public blockchains are a novel way of organising human activity. While the true nature of blockchain as a coordination mechanism is up for thorough analysis, it appears to be a form of self-governing network. Within the context of administration frameworks, blockchain as a coordination form aligns more with the characteristics of a NPG framework but it still may provide use for NWS framework policies, as blockchain can be adapted to meet specific needs. However, blockchain as a general purpose technology has been the focus point of this thesis.

Since the NPM paradigm, e-government initiatives have been praised for lowering public sector costs and increasing efficiency. In the context of the NPM framework, lowering costs and increasing public sector efficiency was the main value provided by IT systems. This main value provided by IT has changed in recent decades from e-government to e-governance, following wider societal and policy trends. Whilst e-government's main purpose was to reduce costs and increase public sector efficiency, it has now developed into a broader tool of e-governance. As an IT governance tool, it encompasses e-government as well as citizen-centric and horizon coordination concepts. The type of services provided by e-governance can be extended with blockchain through enhancing the public administration on two fronts. On one hand, private blockchains increase intra- and inter-organisational capabilities and provide another layer of cost reduction. Using private blockchains as a unified data exchange platform allows organisations to optimally govern data flows, always being up to date and having cross-organisational data access. This constitutes to the administration framework in which blockchain technology is used to make the public sector operate better, focusing on increasing inner capabilities and routines. On the other hand, public blockchains lean towards the domain of e-governance, focusing on e-participation by the means of public and transparent blockchains. Whether

to be adopted only in certain communities or in society in general, public blockchains provide a new form of governance that can incentivise participant activity through tokenomics. Similar to multiple ongoing token-based blockchain developments, tokens provide a money-free system to trade currency for services. Furthermore, tokens have the added benefit of retaining value in the blockchain ecosystem. This version of public blockchain is not limited to a single service, but could be implemented in smaller communities stretching clusters of services. Having a common value basis renders transactions near feeless in such a community. In general, blockchains may extended the tools of e-governance more towards horizontal solutions and services that are not just digital representations of existing public services. The NWS-style blockchain applications are linear in nature and provide additional cost reduction and administrative capability most all, with public blockchain ranging from open databases to completely money-free token based systems. In conclusion, the benefits of the blockchain is reflected in the framework it is implemented in.

Utilising blockchain in the context of NPG combines the abstract or human concept of networks with the digital concept of networks. NPG framework's primary focus lies on pluralism and network governance. Value is generated through multi-actor participation, feedback and input. These actors need to physically transfer ideas, thoughts to progress the system. Blockchain provides a unified platform to manage the network participant activity. Referencing the image in chapter 1.2., the tools of NPG can be expressed through blockchain. Transparency can be logged and achieved through a public blockchain and so can the service user input. Considering how blockchain has evolved by itself without government assistance, mostly within the gray areas of regulatory frameworks, the majority of blockchain projects necessitate the decentralisation of authority, emphasizing transparency. A blockchain project such as EOS, a wider multi-purpose platform, has received criticism for being centralised because the network relies on 21 nodes, instead of thousands of nodes. In this perspective, the NPG ethos seems to be well represented within the current wave of blockchain applications. Aside from decentralisation, what NPG and blockchain both seem to reflect is the complexity of modern societies. Even though the concept of global networks is not really part of the NPG framework, global public blockchains can be viewed as supersized, inflated versions of NPG style governance models. The underlying bottlenecks in both NPG and blockchains are the same. Centralisation in modern civilisation is partly due to the fact that is currently much more cheaper, as gaining consensus from a network with hundreds or thousands of actors requires an abundance of times, money and patience.

Similarly, achieving consensus in a digital network with thousands of actors is costly. The latest generation of blockchain application, known as blockchain 3.0, focus on the networks being instantaneous, feeless and miner-less. If properly developed, global (global) networks would have few technological weaknesses and the focus will shift towards the governance of such networks, reaching consensus and maintaining operational stability.

Blockchain's role in the NWS frameworks is a lot less convoluted compared to the case of NPG. The blockchain application in this context is linear, the value of blockchain is generated through accountability (the immutability of blockchain) and through having a unified platform. NWS' aim of enhancing the bureaucracy is already happening with the help of private blockchains. They do not contest the current form of governance, thus the public sector can apply blockchain technology and gain its benefits without completely restructuring itself. Private blockchain in a NWS style governance provides increased efficiency and can unify the efforts of different organisations through a singular blockchain platform. Blockchain characteristics such as immutability and access control align with Weberian legacy concepts of auditability and accountability. Perhaps the most intriguing aspect of NWS and blockchain is how NWS framework reacts to the growth of (public) blockchain governance. Similar to how bitcoin has grown outside of the existing financial structures while being a competitor to fiat currency, blockchain provides the platform to develop governance networks outside of the governmental structures. This aspect of the evolution of blockchain is currently not discussed, but it may grow into a larger discussion in the future. As the only way of shutting down a decentralised blockchain is to shut down the internet, the discussion of large scale public blockchain (such as blockchain voting or contract platforms) legitimacy seems inevitable.

To sum up, modern reform frameworks' scope of governance includes citizens more or less as an active part of public administration. As the criteria for providing public services has increased, e-government and e-governance have become invaluable tools for public service delivery. Nonetheless, societal pressure and financial restrictions force governments to constantly upgrade their arsenal of IT tools. Blockchain seems to provide benefits in multiple ways, as it is flexible and can be implemented on top of existing IT systems. The scope and depth of blockchain adoption is dependent on the broader reform trajectory. As blockchain does not solve governance, it amplifies the impact of

existing system. Therefore, the best of blockchain is only exposed if it is implemented in a manner that is consistent with the rest of the government's policy choices.

3.2. Lessons from Estonia

To understand whether the Estonian PA benefits from blockchain technology, knowing the main reform trajectories is not enough. Another vital component of developing successful policy choices, in addition to knowing the policy goals (reform frameworks), is knowing the current state of PA. Estonia has a fragmented and decentralised public administration (OECD 2011, 25). The resources available to the public sector are not used to their fullest extent, which is also reflected from the interviews. Organisations seem to want to extend cooperation with other organisation, and in some cases (healthcare) the sustainability of organisations is dependent on cooperation. In this case, organisations have two competing goals: increase their own efficiency and work towards cooperation with other organisations. E-government and e-governance can be part of the solution for both goals, but the initial design of those IT systems is crucial in order to not make old mistakes. In the case of a fragmented public administration, simply utilising blockchain does not resolve underlying issues.

Estonia has experienced the negative side-effects of NPM reforms and has been advised to increase public sector capacity and practice Good Governance through "post-post-NPM" reforms (Drechsler 2004, 394). Drechsler (2004) and Randma-Liiv (2008) has suggested a (Neo) Weberian-based PA, citing weak civil society as one of the reasons. A NWS style governance is also reflected on the paths taken by organisations interviewed, strengthening the organisation itself is the top priority. Estonia's focus towards NWS style reform is further reinforced by their action plan goals: achieving better public services, decrease in administrative burden for citizens and businesses and improvement in cooperation between the participants (Riigikantselei 2016, 33). The more the public sector leans towards complex IT system, the more important it becomes to cooperate with shareholders and third parties. Estonian digital authorities have emphasised, that the adoption of e-services does not only rely on the technical capabilities but also on the public perception and trust (Veebel 2018). The public perception can only grow, if there exists policy cohesion, a stability regarding policy makers' work.

Many of the e-governance developments in Estonia are not globally exportable, because they rely on Estonian legislation and organisational culture (Kalvet et al 2013, 176). The e-Residency program was an antidote to that issue, not by getting the technology to others, but by getting others to our technology, by becoming a digital resident. In the upcoming years when legislation is catching up with blockchain projects, Estonia's importance in blockchain governance will increase. Regardless, X-Road has been a successful step towards a lean government, mitigating several of the aforementioned public sector inefficiencies. It has proven that blockchain can increase public sector efficiency and inter-organisational cooperation (Kalvet et al 2013, 8). Within the context of a specific organisation, the case for using blockchains as isolated organisation-specific solutions is not clear. In the context of administrative area blockchain applications, there are two important aspects: IT system uniformity and public servant skills. In general, organisations seem to be moving away from isolated IT solutions towards unified platforms. This path requires multiple organisations to work simultaneously, providing a management challenge to an already fragmented public administration. In addition, there are further challenges such as the initial resource investment and the need to re-train servants, all of which may offset the marginal increases in organisational efficiency thanks to blockchain. Currently, Estonia provides a case in which private blockchain has been successfully utilized in the public sector as part of the X-Road technology. Public blockchain initiatives may prove themselves important when the specific use cases can be defined, whether in regards of co-production or open innovation. In the case of KEMIT, there does not seem to be an obvious use for blockchain, however the issue they faced with managing project proposals from other organisations within the Ministry of Environment administrative area could be managed with a private blockchain solution. In that case, the main benefit of blockchain would not be decentralisation, but rather managing inter-organisational data, proposals.

Even though this thesis does not provide an exhaustive list of possibilities for blockchain use in Estonia, key elements have been determined in order to further explore blockchain use. Based on the empirical results, Estonian public sector organisations tend to utilise or develop IT solutions to increase intra-organisational capabilities, even though their organisational culture values involvement and network input highly. Once core unified IT systems are developed, the blockchain use case in the Estonian PA becomes more apparent.

3.3. Uses in Public Administration

The first application for the internet was simply sending emails, but it has grown into something that has revolutionised communication and more. Similarly, blockchain is currently most used for store of value, i.e. cryptocurrencies, but it has the characteristics to provide value in numerous other ways. The future of public administration will most likely include blockchain as a central technology in one form or another, but whether blockchain will be adopted only as private blockchain as means to increase organisational capacity or will it be used as public blockchains as tools to initiate co-production, is yet to be explored. The Netherlands is a leading country in blockchain pilot projects where banks, insurance companies, other private companies work alongside the Dutch regulatory authority to co-develop a blockchain framework and determine use cases. In recent years, the Dutch government has launched more than 30 pilot programs in government organisations, ranging from Ethereum-based financing projects within the Ministry of Finance to managing parking licenses for disabled people in the municipality of Schiedam (Schenker 2017). The Dutch example demonstrates that developing use cases stems from governance trajectories, which in their case is from horizontal cooperation.

Reflecting from the interview results, organisations showed interest in automating tasks and data flows. The need to synchronise data and automate mundane processing tasks is something Ethereum blockchain smart contracts[17] are able to do. The use for smart contracts in PA is evident in the case of the Environmental Board. The organisation issues thousands of permits, but the requirements for those permits are often verified by humans. For example, if a entrepreneur applies for a woodcutting permit, a human has to physically compare nature reserve maps and do other mundane processes. However, there may be existing digital data regarding nature reserves and a smart contract could connect with blockchain databases, verify the application and notify the need for human intervention, if need be. Effectively, smart contracts could automate most tasks regarding strict data and binary outcomes. While machine learning is something that is not currently commercially viable, blockchain and smart contracts are already existing technologies. Smart contracts lean more towards NWS blockchain toolkit, as their main focus is standardisation of services and reduction of administrative costs.

[17] Smart contracts are blockchain based automated protocols. Smart contracts can utilize an “if-this-then-that” logic, providing a specific outcome with a specific input.

Blockchain has markedly increased in cooperative efficacy — the ability to solve problems cooperation through voluntary mechanisms (Nair et Sutter 2018, 547). Technology in general has introduced new forms of co-production and shifted it from a human-centric approach to automation (Lember 2017, 13). Combining the data gathered by the government and blockchains ability to safely manage that data. The government could provide an informational or technological platform, open data government being one of such examples (Mcbride et al 2017, 17). Private blockchains with few nodes have little reason to use tokens, but public blockchains can utilize tokens to incentivise maintenance and interaction with the blockchain, the token system can be used by the public sector to initiative collaboration between network actors. Citizens could receive tokens for participation and the token can be used for more than just cashing in on fiat currency, they could be used to pay for public services. Open data government solution could work similar to the Estonian X-Road, where the access of data is logged. Private entities and citizen have access to government data and they can build their services to rely on that data. The data is accessed automatically and the data is anonymous to the visitor. Open data government generally falls the framework of NPG, involving citizens in public service development and delivery.

The third public sector blockchain application proposed in this thesis is the concept of tailored public services. Tailored public services combines previously mentioned smart contracts, machine learning and provides the citizens intuitive services, pre-filtered specifically according to the user's needs. For an example, if a person's ID card nears its expiration date, the system would automatically filter out the closest government offices to the citizen and send a notification to the citizen with a proposed date to renew the ID card. Using the data available to the government and the efficiency of blockchain, public services could be set up as subscription services (Swan 2015, 44). From a reform framework perspective, tailored public services would have elements of both NPG and NWS frameworks, providing more efficient public services with the help of the citizens.

Conclusion

Blockchain is a decentralized ledger technology that is disrupting multiple industries. Blockchain's value relies on having the ability to transact without an intermediary, effectively reducing transaction costs. Whilst the first use for blockchain was Bitcoin, more and more governments have adopted or are experimenting with blockchain in the public sector. The current academic literature focuses on blockchains application in different fields and there only a few studies discussing the impact of blockchain on the public administration. As an exploratory case study focusing on Estonia. This thesis aims to be one of the first analysing blockchain specifically from a public administration perspective. The theoretical framework is based on public administration reform frameworks and focuses on contemporary regimes such as Neo-Weberian State and New Public Governance. In addition, e-governance theory is discussed to bridge the gap between blockchain and reform frameworks. Empirical data is gathered via semi-structured interviews with high ranking public servants and document analysis. To answer the main research question, three sub topics are focused on: contemporary reform frameworks, public administration trajectory in Estonia and future applications for blockchain.

A state's reform trajectory indicates the main policy direction and the underlying tools and mechanisms used. While a government may lean more towards one framework, they utilise aspects from other contemporary frameworks and older frameworks such as NPM and traditional public administration. Having compared NPG and NWS frameworks and the features of blockchain, blockchain technology falls under either of those paradigms as a viable e-governance tool. In the case of NPG, blockchain has innate similarities with the resource allocation mechanisms of NPG, which is through open networks. In the case of NWS, blockchain can offset the top-down hierarchical nature of NWS, increasing the efficiency of the public sector.

Estonia is one of the leading countries in terms of using blockchain in the public sector. Blockchain enables their X-Road digital infrastructure, which is used extensively in the public sector. The X-Road has proven to be useful thus far in increasing the efficiency of the public sector. The Estonian case has demonstrated that blockchain first of all provides increased operative efficiency, but it could enhance intra-governmental legitimacy and it could be used to transform public services. There is lack

of interest in blockchain in Estonian public sector organisations, mostly due to resource restriction, even though e-governance solutions are looked forward to.

Future potential blockchain use cases, besides those that are already provided by the Estonian X-Road, could combine other technological advances to those of blockchain. Considering the organisational need for machine learning and the capabilities of blockchain smart contracts, tailored public services may prove to be a beneficial solution both for the state and the citizen. Smart contracts could be a safe way to automate organisational procedures, whilst machine learning filters data to be most relevant for the citizen. This way, the administrative and bureaucracy costs are lower and citizens receive services tailored for their specific needs. Open data government is another tool which can be adopted with the help of blockchain. Open data government refers to citizens being able to access government's data, while blockchain guarantees the anonymity, safety and access of that data.

This thesis has several limitations. The thesis at hand focused on the case of Estonia, thus the results and conclusions may not apply to other countries with a different regulatory framework and cultural approach towards technology. In addition, due to the exploratory nature of this research, cases were selected for a wide range of opinions and viewpoints. The wider approach of the thesis may provide explanations for general trends, but it does not confirm blockchain capability of benefits for specific organisation types or even sectors. Additionally, analysing cases from a single sector may provide more cohesive conclusions.

In terms of practical contribution, this research provides several conclusions, progressing the discussion of blockchain governance. Blockchain in PA has been reaffirmed as a valuable tool, taking both e-governance and e-government to the next level. Within the e-governance context, tailored public services, smart contracts and blockchain based open data government have been referenced as next generation blockchain tools. In regards to reform frameworks, it has been established that the discussion of blockchain needs to include a general description of the blockchain in view (centralised vs. decentralised; private vs public), as the outcomes of blockchain governance are dependent on its initial design. Blockchain in the Estonian case has been analysed: while being an exceptional e-government tool via the X-Road, organisational struggles to advance blockchain from an e-government tool to and e-governance tool.

Future research of the convergence of PA and blockchain could have several focuses. Firstly, other theoretical frameworks can be used, such as organisational theory or PA technological capacity approach. Both perspective provide insight into the specifics of blockchain within the context of a single organisation. In the organisation theory context, trust becomes an important aspect, as blockchain "eliminates" trust, while traditional organisations operate based on trust. Blockchain as a form of coordination is still an under-researched topic, lacking empirical evidence. Validating whether blockchain can be used as an alternative for markets and networks provides significant contribution in blockchain governance and blockchain in the context of a specific reform framework. Similarly how e-governance as a framework has specific tools, the blockchain governance topic requires a clear model for further discussion. Secondly, the use case of blockchain in different PA organisations is still not yet clear. As time passes, future research has additional empirical evidence to rely on to make more profound conclusions. Thirdly, specific blockchain applications such as smart contracts and decentralised autonomous organisations are already concepts, that some PA organisations envision utilising. Lastly, blockchain from a political perspective has many facades. Public blockchains are hyper-political in a way, thus their legitimacy in the eyes of the state is still obscure.

Kokkuvõte

Plokkahel avaliku halduse vaatenurgast: Eesti kaasus

Parol Jalakas

Plokkahel on detsentraliseeritud register, mis võimaldab plokkahela kasutajatel teha turvalisi tehinguid vahemeheta. Plokkahel on jaotatud võrgustiku liikmete vahel ning iga tehingu (andmeuuenduse) järel kajastatakse muudatus kõikide võrgustiku liikmete plokkahelates konsensusprotokolli järgi. Investeeringud tehnoloogiasse on viimastel aastatel suurenenud ning nii eraettevõtted kui ka mitmed riigid eksperimenteerivad plokkahelaga. Samal ajal kui leiab akadeemilist kirjandust plokkahelast spetsiifiliste valdkondade kontekstis, kuid eksisteerivad ainult üksikud analüüsid plokkahelast avaliku halduse perspektiivist ning selle mõjust valitsemisele. Käesolev magistritöö on üks esimesi, mis läheneb teemale spetsiifiliselt avaliku halduse vaatenurgast. Töö on olemuselt uuriv *case study*. Töös on püstitatud üks peamine uurimusküsimus ning kolm toetavat alaküsimust:

- Mis kasu saab plokkahel pakkuda avaliku halduse reformi kontekstis?
    - Millised on päevakajalised avaliku halduse reformi mudelid?
    - Kuidas sobitub plokkahel Eesti avaliku halduse konteksti?
    - Millised on plokkahel võimalikud kasutusvaldkonnad avaliku halduse kontekstis?

Töö teoreetiline raamistik põhineb kolmel peamisel teoreetilisel kontseptsioonil: valitsemine, avaliku halduse reformimudelid ning e-valitsemine. Töö empiiriline osa analüüsib Eesti kaasust ning põhineb kvalitatiivsetel andmekogumise meetoditel. Töö käsitleb tervet Eesti konteksti, kuivõrd ainult X-tee analüüsimine ei anna piisavalt sisendit laiapõhjaliste järelduste tegemiseks. Töö raames viidi läbi mitu poolstruktureeritud intervjuud avaliku sektori organisatsiooni juhtpositsiooni töötajatega. Intervjuude eesmärgiks oli saada sisendit just organisatsioonitasandilt, leida selgitusi sellele, kuidas toimub e-teenuste välja kujundamine ning kuidas valitsemisloogika seda mõjutab. Eesti on üks progressiivsemaid riike plokkahela kasutamise kontekstis, kuivõrd X-tee platvormi kasutatakse Eesti avaliku sektori üleselt ning ka erasektoris. X-tee võimaldab efektiivselt ning turvaliselt hallata konfidentsiaalset informatsiooni ning selle põhjalt teenuseid osutada. Uurimistöö käigus viidi läbi

intervjuud Töötukassa, Haigekassa, Keskkonnaministeeriumi, Keskkonnaministeeriumi Infotehnoloogiakeskuse ja Keskkonnaameti esindajatega. Eesti kaasus demonstreerib, kuidas X-tee ja plokkahela tehnoloogia baasil saab suurendada avaliku sektori efektiivsust ning vähendada administratiivkulutusi. Samal ajal ei ole organisatsioonide siseselt suurt huvi plokkahela tehnoloogia vastu, kuivõrd pööratakse tähelepanu eelkõige masinõppele mõttega, et see tulevikus aitab organisatsioonil automatiseerida tööprotsesse.

Avaliku halduse reformi kontekstis on *New Public Governance* ja *Neo-Weberian State* peamised reformitrajektoorid. Mõlemad teooriad on välja kujunenud uus-haldusjuhtimise tagajärgedest. *New Public Governance* seab pluralistliku fookuse, mille kontekstis kaasatakse avaliku sektori väliseid osapooli teenuste välja arendamiseks ja osutamiseks. Reformitrajektoori kontekstis rakendatakse horisontaalseid koordinatsioonimehanisme ning täiendav rõhk asetseb võrgustikel. *Neo-Weberian State* seevastu peegeldab rohkem traditsioonilise avaliku halduse väärtusi, kus riik täidab oma funktsioone toetudes tugevale ja uuendusmeelsele avalikule sektorile. Toetutakse pigem vertikaalsele koordineerimisel, turumehaanikad ja kaasamine asetsevad taustal. E-valitsuse diskussioonis eksisteerib avaliku halduse reformi akadeemilisele diskussioonile analoog, kus "e-valitsemine" ja "e-valitsus" väljendavad eri kontseptsioone. E-valitsus väljendab pigem IT kasutamist avaliku teenuste osutamiseks. Teisest küljest aga e-valitsemine peegeldab *New Public Governance* trajektoori praktikat, mille raames riik volitab kodanikke läbi riikliku informatsioonikogu ja läbi e-osavõtmise. Mõlema trajektoori puhul on e-valitsemine vahend, misläbi avaliku sektori eesmärke saavutada. Kuivõrd plokkahel võimaldab informatsiooni hallata detsentraliseeritult, turvaliselt ja kindlalt, on plokkahel kasutamisvõimalused avaliku halduse kontekstis laialdased.

Käesolev töö on pakkunud välja kolm võimalikku rakendusvõimalust plokkahela jaoks avalikus sektoris: nutikad lepingud (inglise keeles *smart contracts*), personaliseeritud avalikud teenused ja avatud valitsuse platvorm. Nutikad lepingud on plokkahelal põhinevad automatiseeritud tehingud, millega tagatakse kindel väljund kindla sisendi puhul. Avaliku sektori kontekstis saab nutikate lepingute automatiseerida lihtsamad tööprotsesse, näiteks väljastada lepinguid või trahve. Personaliseeritud avalikud teenused hõlmavad endas masinõpet ning plokkahela kombineerimist. Masinõppe abil saab automatiseeritult esitada kodanikule temale asjakohast informatsiooni. Plokkahel selles kontekstis tagab kodanike andmete turvalisuse. Avatud valitsuse platvorm võimaldab kodanikel

ligi pääseda informatsioonile mida riik oma. Plokkahel võimaldab kontrolli info ligipääsule ja selle õigsust plokkahelas säilitada.

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List of References

Atzori, M. (2015). *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?* University College of London. Available: http://nzz-files-prod.s3-website-eu-west1.amazonaws.com/files/9/3/1/blockchain+Is+the+State+Still+Necessary_1.18689931.pdf, 16.03.2018.

Bauerle, N. What is Blockchain Technology? *Coindesk.* Available: https://www.coindesk.com/information/what-is-blockchain-technology/, 16.05.2018.

Bernhard, Irene. (2014). *E-government and E-governance. Local Implementation of E-government Policies in Sweden.* KTH Royal Institute of Technology.

Bretschneider, S. and Mergel, I. (2011). Technology and Public Management Information Systems: Where We Have Been; Where We Are Going. *The State of Public Administration: Issues, Problems and Challenges*, 187-203.

Broucker, B. and Crompvoets, J. (2014). *E-governance and the future of innovative public sector organisations.* University of Leuven.

Cheng, S. (2017). Using blockchain to improve data management in the public sector. *McKinsey & Company*. Digital McKinsey. Available: https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/using-blockchain-to-improve-data-management-in-the-public-sector, 05.03.2018.

Coffin, B. (2009). *The 2008 Financial Crisis. A Wake-up Call for Enterprise Risk Management*. Risk and Insurance Management Society. Available: https://www.ucop.edu/enterprise-risk-management/_files/2008fincrisis_wakeupcall.pdf, 26.02.2018.

Davidson, S., Filippi, P. D. and Potts, J. (2016). *Disrupting governance: The new institutional economics of distributed ledger technology*. Available: https://ssrn.com/abstract=2811995, 15.03.2018.

Dickinson, H. (2016). *From New Public Management to New Public Governance: The implications for a "new public services"*. Available: http://press-files.anu.edu.au/downloads/press/n1949/pdf/ch03.pdf, 05.03.2018.

Drechsler, W. (2004). *Governance, good governance, and government: the case for Estonian administrative capacity*. TRAMES, 2004, 8(58/53), 4, 388–396.

Drechsler, W. (2013). Three paradigms of governance and administration: Chinese, Western and Islamic. *Society and Economy*, 35 (2013) 3. 319–342 DOI: 10.1556/SocEc.35.2013.3.3

Drechsler, W. and Randma-Liiv, T. (2015). In Some Central and Eastern European Countries, Some NPM Tools May Sometimes Work: A Reply to Dan and Pollitt's 'NPM can work', *Public Management Review*, DOI: 10.1080/14719037.2015.1114137

Eesti Haigekassa põhikiri, RT I, 29.12.2017, 34. Available: https://www.riigiteataja.ee/akt/129122017034, 16.05.2018.

Eesti Haigekassa. (2017). *Eesti Haigekassa arengukava 2018-2021*. Available: https://www.haigekassa.ee/sites/default/files/V_pkp_arengukava.pdf, 16.05.2018.

Eesti Töötukassa. (2017). *Eesti Töötukassa ARENGUKAVA 2018-2021*. Tallinn. Available: https://www.tootukassa.ee/sites/tootukassa.ee/files/arengukava_2018_2021.pdf, 16.05.2018.

Eesti Töötukassa põhikiri, RT I, 31.05.2017, 12. Available: https://www.riigiteataja.ee/akt/131052017012, 16.05.2018.

Ehrsam, F. (2017). Blockchain Governance: Programming Our Future. *Medium*. Available: https://medium.com/@FEhrsam/blockchain-governance-programming-our-future-c3bfe30f2d74

European Commission. (2018). *FinTech Action plan: For a more competitive and innovative European financial sector*. Available: https://ec.europa.eu/info/sites/info/files/180308-action-plan-fintech_en.pdf, 16.03.2018.

Gerard, D. (2017). Estonia's smartcard security problem is probably not blockchain-related — but what is Estonia's "KSI Blockchain"? *David Gerard*. Available: https://davidgerard.co.uk/blockchain/2017/09/06/estonias-smartcard-security-

problem-is-probably-not-blockchain-related-but-what-is-estonias-blockchain/, 10.03.2018.

Greenspan, G. (2015). Private Blockchains are more than "just" shared databases. *Multichain*. Private Blockchains. Available: https://www.multichain.com/blog/2015/10/private-blockchains-shared-databases/, 25.02.2018.

Homburg, V. (2004). *E-Government and NPM: A Perfect Marriage?* Erasmus University Rotterdam. DOI: 10.1145/1052220.1052289.

Iansiti, M. and Lakhani, K. R. (2017). The Truth About Blockchain. *Harvard Business Review.* Technology. Available: https://hbr.org/2017/01/the-truth-about-blockchain, 16.05.2018.

Jayachandran, P. (2017). The difference between public and private blockchain. *Blockchain Unleashed: IBM Blockchain Blog*. Available: https://www.ibm.com/blogs/blockchain/2017/05/the-difference-between-public-and-private-blockchain/, 16.05.2018.

Jones & Bartlett Learning. (2011). *Public Administration and Information Technology*. Available: http://samples.jbpub.com/9780763784607/84607_CH01_FINAL.pdf, 10.03.2018.

Kalvet, T., Tiits, M. and Hinsberg, H. (2013). *E-teenuste kasutamise tulemuslikkus ja mõju*. Tallinn: The Institute of Baltic Studies and Praxis Centre for Policy Studies Foundation. Available: http://www.praxis.ee/fileadmin/tarmo/Projektid/Valitsemine_ja_kodanike%C3%BChiskond/E-teenuste_kasutamise_tulemuslikkus_ja_moju.pdf, 08.03.2018.

Keskkonnaministeerium. (2017). *Keskkonnaministeeriumi valitsemisala arengukava 2018-2021*. Available: https://www.envir.ee/sites/default/files/kkm_vaak_2018-2021_.pdf, 16.05.2018.

Keskkonnaamet. (2016). *Keskkonnaameti arengukava aastateks 2016–2019*. Kättesaadav: https://www.keskkonnaamet.ee/sites/default/public/20162019_Keskkonnaameti_arengukava_kinnitatud_26.05.2016.pdf, 16.05.2018.

Keskkonnaministeeriumi põhimäärus. RT I, 06.03.2018, 13. Available: https://www.riigiteataja.ee/akt/13243657?leiaKehtiv, 16.05.2018.

Keskkonnaameti põhimäärus. RT I, 26.02.2018, 4. Available: https://www.riigiteataja.ee/akt/126022018004, 16.05.2018.

Keskkonnaministeeriumi Infotehnoloogiakeskuse põhimäärus, RT I, 09.03.2018, 23. Available: https://www.riigiteataja.ee/akt/109032018023, 16.05.2018.

Klijn, E. H. and Koppenjan, J. (2012). Governance Network Theory: Past, Present and Future. *Policy & Politics*. 40(4):587-606 October.

Klijn, E. H., Edelenbos, J. and Steijn, B. (2010). Trust in governance networks; its impact and outcomes. *Administration and Society*, vol 42 (2): 193-221. Available: https://repub.eur.nl/pub/20767/trust_in_governance.pdf, 09.03.2018.

Korjus, K. (2017a). Welcome to the blockchain nation. *Medium*. E-Residency Blog. Available: https://medium.com/e-residency-blog/welcome-to-the-blockchain-nation-5d9b46c06fd4, 10.03.2018.

Korjus, K. (2017b). Estonia could offer 'estcoins' to e-residents. *Medium*. E-Residency Blog. Available: https://medium.com/e-residency-blog/estonia-could-offer-estcoins-to-e-residents-a3a5a5d3c894, 11.03.2018.

Kostakis, V. (2011). Commons-Based Peer Production and the Neo-Weberian State: Synergies and Interdependencies. *Halduskultuur – Administrative Culture* 12 (2), 146-161. Available: http://halduskultuur.eu/journal/index.php/HKAC/article/viewFile/45/54, 05.03.2018.

Labaree, R. V. (2018). *Organizing Your Social Sciences Research Paper: Purpose of Guide*. University of Southern California: http://libguides.usc.edu/writingguide, 25.03.2018.

Lehdonvirta, V. (2016). The blockchain paradox: Why distributed ledger technologies may do little to transform the economy. *The Policy and Internet Blog*. University of Oxford: http://blogs.oii.ox.ac.uk/policy/the-blockchain-paradox-why-distributed-ledger-technologies-may-do-little-to-transform-the-economy/, 19.03.2018.

Lember, V. (2017). The Increasing Role of Digital Technologies in Co-production. *Working Papers in Technology Governance and Economic Dynamics*. No. 75 Available: http://technologygovernance.eu/files/main/2017090403424444.pdf, 06.03.2018.

Lember, V., Kattel, R. and Tõnurist, P. (2016). Public Administration, Technology and Administrative Capacity. *Working Papers in Technology Governance and Economic Dynamics*. No. 71. Available: http://technologygovernance.eu/files/main/2016082908550505.pdf, 06.03.2018.

Lynn, J. L. (2008). *What is a Neo-Weberian State? Reflections on a Concept and its Implications*. The University of Chicago. Available: https://www.researchgate.net/profile/Laurence_Lynn_Jr/publication/268398484_What_Is_a_NeoWeberian_State_Reflections_on_a_Concept_and_Its_Implications/links/554767060cf249186bb0f3c0/What-Is-a-Neo-Weberian-State-Reflections-on-a-Concept-and-Its-Implications.pdf , 16.03.2018.

McBride, K., Aavik, G, Kalvet, T. and Krimmer, R. (2016). Co-creating an Open Government Data Driven Public Service: The Case of Chicago's Food Inspection Forecasting Model. *Working Papers in Technology Governance and Economic Dynamics*. No. 76: http://technologygovernance.eu/files/main//2017092108151515.pdf, 17.03.2018.

Martindale, J. (2018). What is a blockchain? Here's everything you need to know. *Digital Trends*. Computing. Available: https://www.digitaltrends.com/computing/what-is-a-blockchain/, 16.05.2018.

Martinovic, I., Kello, L. and Sluganovic, I. (2017). Blockchains for Governmental Services: Design Principles, Applications, and Case Studies. *Working Paper Series*. No. 7. Centre For Technology & Global Affairs. Available: https://www.ctga.ox.ac.uk/sites/default/files/ctga/documents/media/wp7_martinovickellosluganovic.pdf, 12.03.2018.

Markushewski, D., Rabava, N. and Kukharchuk, V. (2016). *Blockchain technology for e-governance*. School of Young Managers in Public Administration. Policy Brief. Available: http://sympa-by.eu/sites/default/files/library/blockchain_egov_brief_eng.pdf, 24.04.2018.

Mazonka, O. (2016). *What is Blockchain: a Gentle Introduction.* Defence Science and Technology Group (DST).

Nair, M. and Sutter, D. (2018). The Blockchain and Increasing Cooperative Efficacy. *Independent Review*. Spring 2018, Vol. 22 Issue 4, 529-550. 22p.

Nakamoto, S. (2008). *Bitcoin: A Peer-to-Peer Electronic Cash System*. Available: https://bitcoin.org/bitcoin.pdf, 26.02.2018.

Nussbaum, J. (2017). Blockchain Project Ecosystem. *Medium*. https://medium.com/@josh_nussbaum/blockchain-project-ecosystem-8940ababaf27, 03.03.2018.

OECD (2011). *Estonia: Towards a Single Government Approach*. OECD Public Governance Reviews, OECD Publishing. http://dx.doi.org/10.1787/9789264104860-en

Oomsels, P. and Bouckaert, G. (2012). *Trust and distrust within public administration: Towards a framework for public management*. *Good Governance as Managing Tensions between Public Values*. 29-30 November 2012. Available: http://steunpuntbov.be/rapport/oomsels_2012_NIG_Trust.pdf, 10.03.2018.

Osbourne, S. P. (2010). *The New Public Governance?* Available: https://edisciplinas.usp.br/pluginfile.php/3343001/mod_resource/content/0/Anexo%20sem%20t%C3%ADtulo%2000582.pdf, 13.03.2018.

Parvin, P. (2018) *Res Publica: Democracy Without Participation: A New Politics for a Disengaged Era*. 24: 31. https://doi.org/10.1007/s11158-017-9382-1

Pazaitis, A, Filippi, D. P. and Kostakis, V. (2017). Blockchain and Value Systems in the Sharing Economy: The Illustrative Case of Backfeed. *Working Papers in Technology Governance and Economic Dynamics*. No. 73 Available: http://technologygovernance.eu/files/main//2017012509590909.pdf, 11.03.2018.

Pollitt, C. and Bouckaert, G. (2011). *Public Management Reform: A Comparative Analysis—New Public Management, Governance, and the Neo-Weberian State*. Available: https://www.academia.edu/11548460/Public_Management_Reform_A_Comparative_Analysis_-_New_Public_Management_Governance_and_the_Neo-Weberian_State, 01.03.2018.

Pollitt, C., Bouckaert, G., Randma-Liiv, T. and Drechsler, W. (2008). *The NISPAcee Journal of Public Administration and Policy Special Issue: A Distinctive European Model? The Neo-Weberian State*. Volume I, Number 2, Winter 2008/2009. Available: http://www.nispa.org/files/publications/ebooks/nispacee-journal.1.2.pdf , 09.03.2018.

Raipa, A. (2011). *The Methodological Analysis of Complexity of New Public Governance Institutionalization*. Kaunas University of Technology. Available: http://www.su.lt/bylos/mokslo_leidiniai/soc_tyrimai/2011_24/raipa.pdf, 11.03.2018.

Randma-Liiv, T. (2008). *New Public Management versus Neo-Weberian State in Central and Eastern Europe*. Trans-European Dialogue 1 towards the Neo-Weberian State? Europe and Beyond. Available: https://iss.fsv.cuni.cz/ISS-50-version1-080227_TED1_RandmaLiiv_NPMvsNWS.pdf, 02.03.2018.

Rajasekar, S., Philominathan, P. and Chinnathambi, V. (2013). *Research Methodology*. University of Cornell. Available: https://arxiv.org/pdf/physics/0601009.pdf, 25.04.2018.

Riigikantselei. (2016). *Action plan for developing administrative capacity and implementing the recommendations of the OECD Public Governance Review*. Available: https://riigikantselei.ee/sites/default/files/riigikantselei/strateegiaburoo/action_plan_for_administrative_capacity_and_oecd_public_governance_review.pdf, 10.05.2018.

Riigi Infosüsteemide Amet. (2015). *X-tee* tutvustus. Available: https://www.ria.ee/ee/x-tee-tutvustus.html#kellele, 16.05.2018.

Schenker, J. L. (2017). The Netherlands Is Becoming A Blockchain Nation. *Medium*. The Innovator. Available: https://innovator.news/the-netherlands-a-blockchain-nation-a423eebc759e

Sclavounis, O. (2017). Understanding Public Blockchain Governance. *Oxford Internet Institute*. Available: https://www.oii.ox.ac.uk/blog/understanding-public-blockchain-governance/, 20.03.2018.

Sheridan, W. and Riley, T. B. (2010). Comparing e-Government Vs. e-Governance. *Geospatial World*, December 7. Available: https://www.geospatialworld.net/article/comparing-e-government-vs-e-governance/, 24.04.2018.

Swan, M. (2015). *Blockchain. Blueprint for a New Economy*. Available: http://w2.blockchain-tec.net/blockchain/blockchain-by-melanie-swan.pdf, 15.03.2018.

Tapscott, D. and Tapscott, A. (2016). *Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World*. Penguin UK. 0241237874, 9780241237878.

Torfing, J. and Triantafillou, P. (2013). *What's in a Name? Grasping New Public Governance as a Political-Administrative System*. Center for Democratic Network Governance. Available: https://ecpr.eu/filestore/paperproposal/117b16b3-4dca-4657-bf64-178cbe1049dd.pdf, 10.03.2018.

Tõnurist, P., Lember, V and Kattel, R. (2016). Joint data platforms as X factor for efficiency gains in the public sector? *Working Papers in Technology Governance and Economic Dynamics.* No. 70. Available: http://technologygovernance.eu/files/main//2016082501020202.pdf, 02.03.2018.

Veebel, V. (2018). E-Democracy in the European Union: Lessons from Estonia. *Foreign Policy Research Institute*. Baltic Bulletin. Available: https://www.fpri.org/article/2018/02/e-democracy-european-union-lessons-estonia/, 12.03.2018.

Verhoest, K., Peters, G., Beuselinck, E., Meyers, F. and Bouckaert, G. (2005). *How Coordination and Control of Public Organizations by government interrelate: an analytical and empirical exploration*. Available: https://soc.kuleuven.be/io/pubpdf/io02060016_coordination_scancor.pdf, 16.03.2018.

White, M., Killmeyer, J. and Chew, B. (2017). Will blockchain transform the public sector? *Deloitte Insights*. Available: https://www2.deloitte.com/insights/us/en/industry/public-sector/understanding-basics-of-blockchain-in-government.html, 20.03.2018.

Whitworth, B. (2009). *A Brief Introduction to Sociotechnical Systems*. Massey University Auckland, New Zealand. Available: https://pdfs.semanticscholar.org/bb3b/bd2de888ed18c5e8a31910d8a4d49b8db580.pdf, 15.03.2018.

Wright, A. and Filippi, P. D. (2015). *Decentralized Blockchain Technology and the Rise of Lex Cryptographia*. Available: https://ssrn.com/abstract=2580664, 15.03.2018.

Xia, S. (2017). E-Governance and Political Modernization: An Empirical Study Based on Asia from 2003 to 2014. *Administrative Sciences* (2076-3387).

Zamfir, V. (2017). Against on-chain governance. *Medium*. Available: https://medium.com/@Vlad_Zamfir/against-on-chain-governance-a4ceacd040ca, 29.03.2018.

Appendices

1. Interview Questions

Sample questions:

- What is the interviewee's role in the organisation?
- What are the routines and tasks of the interviewee?
- How is the organisations positioned in its administrative area?
- How is the organisation governed?
- What is the value basis for managing the organisation?
- How does the organisation cooperate with other institutions?
- How does the organisation cooperate with citizens?

- Which e-services does the organisation provide?
- What is the basis for providing those e-services?
- How are those e-services developed?
- What are the future technologies to be utilised for the organisation?

2. Interviews Conducted

All interview were conducted by the author

- Representative of the Environmental Board. Audio recording. 10.05.2018.
- Representative of the Health Insurance Fund. Audio recording. 09.05.2018.
- Representative of the Unemployment Insurance Fund. Audio recording. 03.05.2018.
- Representative of the Ministry of the Environment. Audio recording. 13.04.2018.
- Representative of the Information Technology Centre of the Ministry of the Environment. Audio recording. 08.04.2018.