Cumulative dissertation

Towards a joint public service delivery? The effects of blockchain on the relationship of public administrations with external stakeholders

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ABSTRACT

Public administrations confront fundamental challenges, including globalization, digitalization, and an eroding level of trust from society. By developing joint public service delivery with other stakeholders, public administrations can respond to these challenges. This increases the importance of inter-organizational governance—a development often referred to as New Public Governance, which to date has not been realized because public administrations focus on intra-organizational practices and follow the traditional "governmental chain."

E-government initiatives, which can lead to high levels of interconnected public services, are currently perceived as insufficient to meet this goal. They are not designed holistically and merely affect the interactions of public and non-public stakeholders. A fundamental shift toward a joint public service delivery would require scrutiny of established processes, roles, and interactions between stakeholders.

Various scientists and practitioners within the public sector assume that the use of blockchain institutional technology could fundamentally change the relationship between public and non-public stakeholders. At first glance, inter-organizational, joint public service delivery could benefit from the use of blockchain. This dissertation aims to shed light on this widespread assumption. Hence, the objective of this dissertation is to substantiate the effect of blockchain on the relationship between public administrations and non-public stakeholders.

This objective is pursued by defining three major areas of interest. First, this dissertation strives to answer the question of whether or not blockchain is suited to enable New Public Governance and to identify instances where blockchain may not be the proper solution. The second area aims to understand empirically the status quo of existing blockchain implementations in the public sector and whether they comply

with the major theoretical conclusions. The third area investigates the changing role of public administrations, as the blockchain ecosystem can significantly increase the number of stakeholders.

Corresponding research is conducted to provide insights into these areas, for example, combining theoretical concepts with empirical actualities, conducting interviews with subject matter experts and key stakeholders of leading blockchain implementations, and performing a comprehensive stakeholder analysis, followed by visualization of its results.

The results of this dissertation demonstrate that blockchain can support New Public Governance in many ways while having a minor impact on certain aspects (e.g., decentralized control), which account for this public service paradigm. Furthermore, the existing projects indicate changes to relationships between public administrations and non-public stakeholders, although not necessarily the fundamental shift proposed by New Public Governance. Lastly, the results suggest that power relations are shifting, including the decreasing influence of public administrations within the blockchain ecosystem. The results raise questions about the governance models and regulations required to support mature solutions and the further diffusion of blockchain for public service delivery.

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1. INTRODUCTION

This chapter introduces the motivation of this dissertation, including the overall objective. Subsequently, the relevant research questions are derived from this objective. The chapter also explains the research design chosen to answer the research questions and closes by presenting the articles that implement the research design.

1.1 Motivation

This dissertation is grounded in the belief that information technology (IT) should fulfill a functional purpose. Consequently, strategic approaches or technical solutions should focus on the actual needs of public administrations and their stakeholders, for example, citizens and businesses. It is not useful to follow IT trends without adding value in terms of organizational goals (Lenk, 2018) and this principle applies to the use of blockchain.

For the definition of this dissertation's scope, it is important not to focus solely on today's public administration reality. It also crucial to adjust the research around the question of the direction in which public administrations could develop from a scientific perspective and how blockchain could contribute or is already contributing to this development. As stated in chapter 2, that "next level" for public administrations leads to New Public Governance. This reform paradigm puts the relationship between public and non-public stakeholders at the center of a joint public service delivery. This lines up with the focus of public administrative sciences on analyzing the relationship between public administrations and concerned stakeholders (Bohne, 2018). The analysis can be based on both theoretical and empirical grounds (Möltgen-Sicking & Winter, 2018), allowing a better understanding of how blockchain is affecting, and at best supporting, the desired relationship change being driven by New Public Governance.

Many advocates of blockchain in practice and science praise the technology's disruptive character (e.g., Lianos, 2019; Ziolkowska, 2021). It could be assumed that, in theory and on a high level, the technology of blockchain could enable public governance paradigms, in this case New Public Governance. Critics have expressed doubts on this positive perception, however. To help reconcile these diverging areas (Lange, Leiter, & Alt, 2019) this dissertation focuses attention from a scientific standpoint. Accordingly, the objective of this dissertation is defined as follows:

> *Objective: Practically substantiate the theoretical effect of the use of blockchain to enable New Public Governance.*

This objective acknowledges the theoretical and limited empirical work currently available by emphasizing empirical insights and methods (e.g., Batubara, Ubacht, & Janssen, 2018; Risius & Spohrer, 2017).

1.2 Research questions

The objective mentioned above aims to enhance theoretical concepts by linking them with empirical evaluations. This linkage should provide strategic orientation for leveraging opportunities while identifying obstacles and limitations (Deckert, 2019). Aligned with this objective, three corresponding research questions are defined.

> *Question #1: In what ways does the technology of blockchain fit with New Public Governance?*

This question focuses on the conceptual classification of New Public Governance and blockchain. The assumption is that blockchain needs to provide adequate functionalities to enable New Public Governance. Therefore, the concepts of New Public Governance and blockchain need to be structured and analyzed in a way that allows comparison. The answer is also obtained by leveraging existing use cases and including expert opinion from practitioners and researchers. Until now, the literature has not provided anything approaching this.

Question #2: What changes to stakeholder relationships can be observed today that have been brought about by the use of blockchain?

This second question aims to understand empirically the status quo of existing blockchain implementations in the public sector and whether they confirm major theoretical assumptions. Has the project taken New Public Governance into account? How did the use of blockchain promote a joint public service delivery? The general scope of the question, that is the empirical evaluation of the status quo, is typical for public administrative sciences (Binder, 2018). To gain understanding, suitable projects are analyzed.

Because the implementation of blockchain for public service delivery is expected to dramatically increase dependence on technology, it is crucial to understand this dependency and its relevance for public administrations. The third research question elaborates on this.

Question #3: How is the power of public administrations changing with the introduction of blockchain?

The use of blockchain means that public administrations must accept new stakeholders and roles that can theoretically impact their own solutions. Hence, research question 3 acknowledges that power relations change and influence can shift from one stakeholder to another within the blockchain ecosystem. Public administrations need to understand how, why, and in what direction power shifts. The governance structure, especially in public blockchain scenarios, is complex and partly nontransparent. The answers to question 3 are derived from a designed framework to assess stakeholder relationships and shed light on the changing position of public administrations.

As illustrated by these research questions, this dissertation promotes a strongly interdisciplinary approach. Bringing together the fields of public administrative science and information systems in the public sector is at the heart of this effort and answers the call of scientists for strengthening this multidisciplinary approach. Complex societal developments and intersectoral problem areas require interdisciplinary research (Möltgen-Sicking & Winter, 2018).

1.3 Research design

Applying IT in the sense of electronic government (e-government) to all levels of public administrations concerns information systems in the public sector (Bohne, 2018; Disterer, 2019). This area is closely related to business informatics and uses an empirical as well as a construction orientation to explain the "phenomena of reality in and around public administrations" (Disterer, 2019, p. 42) and, consequently, provides suitable IT solutions for the public sector. For this purpose, the area relies on methods and insights from various scientific disciplines, for example, the social, public, or economic sciences, which are then combined with empirical findings (Brunzel, 2017). The combination of knowledge from these disciplines makes the area of information systems in the public sector an integrated subject (Disterer, 2019).

Similar to the area of information systems in the public sector, public administrative sciences are attributed strong empirical traits and a solution-oriented approach (Binder, 2018) to answer questions related to who controls who, how, why, and with what measures. These questions that are ultimately related to the issue of the governance of public and non-public stakeholders (Bohne, 2018). Although scientists dispute the discreteness of public administrative sciences, there is a strong case for public administrative sciences being highly interdisciplinary (Bohne, 2018; Möltgen-Sicking & Winter, 2018). Thus, e-government is partly seen as being relevant to public administrative sciences in terms of efforts to modernize and automate public administrations (Binder, 2018). Binder (2018) refers to the effects of e-government on public and non-public stakeholders as being an area of interest for researchers in the field of public administrative sciences.

Two fundamentals influence this dissertation's research design, accordingly. The first refers to the interdisciplinary nature of this research work, that is, the relation between the major themes of New Public Governance and blockchain technology. The design and its methods elaborate on this relationship. The second fundamental acknowledges the value of empirical science within business informatics (Heinrich, Heinzl, & Riedl, 2011) It attempts both to strengthen the relevance of the results by gaining data from real-life blockchain implementations respectively use cases throughout this dissertation and to combine the data with theoretical insights (Kornmeier, 2007). Consequently, this research is built of three components forming a mixed-method research design. These components can be mapped to the three research questions.

First, the individual concepts of New Public Governance and blockchain and their combined fit are described by evaluating an existing blockchain implementation based on a thorough literature analysis. The conceptual comparison is then further empirically supported through various expert opinions gathered from interviews within a Delphi survey that aim to validate results from the initial analysis.

Second, an explorative and qualitative analysis of existing blockchain implementations for public service delivery draws conclusions as to what degree that conceptual fit is visible. In-person interviews with key project stakeholders conducted with a defined assessment model to then deduce statements on the realization of New Public Governance through blockchain.

Third, the theoretical status quo should be enhanced with respect to changing stakeholder relationships due to the implementation of blockchain. For this purpose, this work is founded on adjusted theoretical concepts, exhaustive desk research, and the analysis of a real-life blockchain implementation via triangulation. The analysis embraces multiple scenarios to allow a scenario comparison of stakeholder influence and to better elaborate the changing stakeholder relationships.

In summary, the three components match the distinct character of this interdisciplinary research objective and fit to the interdisciplinary orientation of business informatics at the conjunction to public administrative science. This research design is further mirrored in the structure of this dissertation's articles.

1.4 Overview of articles and author contribution

This dissertation is based on three articles. They address the research questions and consider the introduced components on the research design. One article was produced in co-authorship. Accordingly, this section has two goals: First, introduce each article in greater detail, including a brief overview of its objectives and the methods used to achieve these objectives. Second, highlight the contribution of each author for the co-authored article. If not stated otherwise, the author of this dissertation provided all leveraged or designed methods and generated the content. Table 1 lists the articles and provides essential information for each.

Table 1: Overview of articles

Article	Title	Author(s)	Journal / Conference	Publication status / year
1	The Implementation of New Public Governance Through Blockchain: Comparing Theory with Empirical Cases	Brinkmann, Maik; Heine, Moreen	Scandinavian Journal of Information Systems	Revision Submitted / 2021
2	The Realities of Blockchain-Based New Public Governance: An Explorative Analysis of Blockchain Implementations in Europe	Brinkmann, Maik	Digital Government: Research and Practice	Published / 2021
3	Relevance of Public Administrations: Visualization of Shifting Power Relations in Blockchain-Based Public Service Delivery	Brinkmann, Maik	Hawaii International Conference on System Sciences	Published / 2021

The first article, presented in chapter 3, focuses on answering the first research question. It discusses the fit between the concepts of New Public Governance and blockchain technology. The detailed objectives are intended to theoretically substantiate the conceptual benefits and limitations of using blockchain to enable the paradigm of New Public Governance. To achieve this, the approach consists of two steps. First, a theoretical structure with defined dimensions is identified to subsequently conduct a multi-scenario analysis. The portfolio of adequate scenarios entails the idealist situation of New Public Governance and an identified real-world use case at the times before and after the implementation of blockchain. The three scenarios are then compared with each other. With the second step, essential findings of the comparison are further validated by various subject matter experts involved in a Delphi survey. The process to prepare and conduct the Delphi survey includes the identification of participants, the design of the questionnaire, and the conclusive analysis of the participants' answers.

Regarding the co-authorship of Moreen Heine, the author of this dissertation designed and executed most sections of the article. Moreen Heine contributed theory on issues of collaborative governance from the perspective of bureaucracy, in addition to her activities as supervisor of this dissertation project.

The second article, chapter 4, covers the second research question—the empirical research efforts. The aim of this article is to identify the relevance of New Public Governance to leading blockchain implementations in the European public sector. To achieve this, the author conducts comprehensive research to find and select relevant blockchain implementations around the world. Furthermore, qualitative interviews are organized and a questionnaire prepared based on the foundations of article 1. The interviews are then conducted with three key project stakeholders in Europe. Once the interviews are transcribed, the empirical findings are connected with the theoretical expectations by leveraging a self-made analysis framework. The concrete article is supplied with chapter 3 of this dissertation.

The third research question, examined in chapter 5, is addressed by the third article, the objective of which is to visualize the shifting power relations caused by the introduction of blockchain. Visualizing a shift means to move from an initial situation to a new situation. Consequently, three fundamental scenarios are identified. Following this, an extensive literature study gathers a reliable understanding of the multi-layered blockchain technology stack and identifies and assigns the various stakeholders to each scenario and technology stack layer. In another extensive effort, a framework for stakeholder analysis is designed and applied for each stakeholder in each scenario and technology stack layer. Finally, the results are assessed and visualized by leveraging an adjusted multi-stakeholder influence mapping tool to compare shifts in power. This article was published and presented in front of an online audience as part of the 54th Hawaii International Conference on System Sciences.

For the sake of completeness, a fourth article was published by this dissertation's author and Moreen Heine as part of the International Conference on Theory and Practice of Electronic Governance (ICEGOV) 2019 and presented during that event. This article elaborates the theoretical match between blockchain and New Public Governance. Due to similarities with the first article, the conceptual fit between New Public Governance and blockchain, it is not included in the main part of this dissertation but integrated as appendix A3.1.

2. THEORETICAL FOUNDATIONS

This chapter lays the theoretical foundations for the major themes of this dissertation. The public governance paradigm of New Public Governance is introduced by elaborating on the development trends in public administrations respectively public service delivery. Furthermore, the chapter recognizes the value of digitalization for public administrations and leads over to the remarks on blockchain and its overarching concept. This chapter closes with the current state of research for this dissertation's scope, which comprises an overview of contributions, shortcomings, and challenges before this dissertation.

2.1 New Public Governance

Public administrations face challenges that tend to be imposed from outside the organizations rather than from inside, for example, internationalization, digitalization, and demographic change (Möltgen-Sicking & Winter, 2018).

Questions on how to effectively and efficiently deliver public services arise (Gökbinar, 2020) and lead public administrations to scrutinize their established processes and roles (Zwitter & Hazenberg, 2020). The challenges also call for a focus on the interactions with affected stakeholders (Bauer & Becker, 2018; Schneider, 2018). To adequately respond to these pressing topics, public administrations should work toward the networking of public administrations (Zwitter & Hazenberg, 2020). This involves non-public and public stakeholder capacities in the planning and execution of administration processes and services (Koppenjan & Koliba, 2013; Möltgen-Sicking & Winter, 2018). The collaboration of multiple stakeholders to solve complex problems bears new challenges, especially in an inter-organizational setting. Differing interests of involved stakeholders, problems understanding, and diverging value sets can make collaboration difficult (Klijn, 2012).

This involvement of other stakeholders does not end with the definition of interfaces but requires a holistic consideration and fundamental realignment of the organization (Misgeld, 2018) and stakeholder relationships (Bogumil & Jann, 2020). The underlying theoretical basis for this type of public administration is described with the concept of governance (Bohne, 2018; Möltgen-Sicking & Winter, 2018).

This shift toward a governance-oriented, inter-organizational perspective for public service delivery has hardly been realized to date (Misgeld, 2018). Instead, public administrations mostly continue to focus largely on an intra-organizational perspective, as inspired by the reform approach of New Public Management (Bogumil, Grohs, Kuhlmann, & Ohm, 2007; Möltgen-Sicking & Winter, 2018; Pestoff, 2012; Xu, Sun, & Si, 2015). In contrast to the inter-organizational perspective, New Public Management focuses on changes to the inner organization. Goal setting occurs from the inside, and techniques such as outsourcing of functions, rather known from private organizations, are applied to increase efficiency (Klijn, 2012).

Ansell and Torfing (2021) assert that the public sector has tried to leverage its resources as efficiently as possible by, for example, by rationalizing organizations and conducting productivity measures. As a result, they inferred, public administrations have only limited leeway and "further cuts in public expenditure are likely to hurt public employees, reduce service quality, and erode the political and professional capabilities" (Ansell & Torfing, 2021, p. 4). Hence, New Public Management and its economic orientation (Bogumil, Jann, & Nullmeier, 2006) is insufficient (Möltgen-Sicking & Winter, 2018) and needs to be expanded to include an inter-organizational perspective (Osborne, 2010). Otherwise, public practitioners will miss the opportunity to leverage non-public capacities to provide solutions for social issues (Beer, 2011).

The relevance of governance

The concept of governance received much attention over the last two decades among public administration scholars. It is also relevant for other disciplines in various ways (Zumbansen, 2012) with different meanings (Kooiman, Bavinck, Chuenpagdee, Mahon, & Pullin, 2008). Forms of governance consist of structural and process components. The former relates, for example, to matters of hierarchies or negotiation systems, while the latter refers to processes of coordination or interaction among actors (Börzel, 2008) of social systems (Katsamunska, 2016). Coordination can take place in a hierarchical or non-hierarchical setting. Hierarchical governance processes leverage instructions that others must follow. In contrast, non-hierarchical governance processes are based on voluntariness (Börzel, 2008) and consider concepts of choice, conflict, or dispute (Zumbansen, 2012) to reach consensus. Although the forms are not limited to private actors, most literature on governance focus on these actors (Christensen & Lægreid, 2012).

Governance can assume various intra- or inter-organizational forms and does not prefer any of these forms. For this dissertation, however, governance with its inter-organizational perspective is perceived as the leading paradigm (Bohne, 2018; Casady, Eriksson, Levitt, & Scott, 2020; Möltgen-Sicking & Winter, 2018) and most-used theoretical approach within social and public administration sciences (Bohne, 2018). This is in line with Bauer and Becker (2018, p. 10), who concluded that the "relationship between citizens and administration is increasingly becoming the subject of administrative science analyses." The concept of governance in this sense has been given multiple names, including Digital-Era Governance (Dunleavy, 2005) or New Public Governance (Osborne, 2010), sometimes with a slightly different emphasis but always relating to the idea of a shift toward inter-organizational governance for public service delivery. New Public Governance is used throughout this dissertation because it has a strong conceptual character without prescribing a form (e.g., digital) of implementation.

Collaborative governance is an integral discipline of governance for public purposes, sometimes referred to as "co-production" (Van Thiel, 2014). It refers to the empirical concept of collaboration between stakeholders (Ansell & Gash, 2007) that strongly supports the realization of the New Public Governance paradigm. In normative terms, collaborative governance seeks to involve multiple stakeholders, allowing them to jointly make decisions and develop regulated and transparent decision-making structures (Bohne & Bauer, 2011).

In summary, the scientific community offers a bold perspective on how public administrations can shape the relationship with their stakeholders by leveraging non-public capacities more strongly. Public administrations, which still mostly focus on intra-organizational measures to tackle today's challenges, understandably need persuasive arguments, or tools, to start this presumably long and costly journey. The question here is what IT can contribute as a key enabler in public governance (Ansell & Torfing, 2021) and catalyst for changing working modes, as it already has with other business models.

The value proposition of digitalization

The growing use of IT not only shifts analog information into the digital world but can also lead to holistic process designs that span multiple stakeholders and increase information flows. Thus, digitalization is a chance for the relationship between public administrations and their stakeholders to improve its level of transparency and interactive exchange (Martini, 2018). Realizing these improvements requires public administrations to keep up with their fast-moving stakeholders. Hess (2018) defines digitalization in the context of public administrations as the process of automation through IT. Tasks, he continues, are then executed by computer, not by humans.

As outlined in this section, joint public service delivery presents a promising vision for public administrations. This vision demands a high level of process integration across organizations to be effective. A digitalized public administration can support this effort, but the vision means more than just transferring physical documents into the digital world and offering portals to other stakeholders (Martini, 2018; Schneider, 2018). As such, definitions that reduce digitalization to the automation of existing processes and tasks (Hess, 2018) and only seek for efficiency gains (Schmid, 2019) appear to fall short. Digitalization should also question established processes and structures as well as focus on the relationships of a public administration (Disterer, 2019).

Joint public service delivery can be closely linked to the understanding of e-government, that is, the electronic execution of public administrations' processes, where those processes relate to either intra-organizational or inter-organizational domains (Möltgen-Sicking & Winter, 2018), for example, in the sense of Government2Government, Government2Business, or Government2Citizen, and vice versa. However, e-government can appear in different degrees of maturity. Misgeld (2018) argues that public administrations can develop from being organizations still requiring their stakeholders to physically appear, or ones that simply offer bundled public services, to become organizations proactively or even predictively (Scholta, Mertens, Kowalkiewicz, & Becker, 2019) delivering public services without additional efforts (e.g. filling of applications) for their stakeholders. Implementing this vision of a more mature e-government cannot be done by public administrations alone but requires collaboration with non-public stakeholders. Collaboration and contribution range from the joint planning of silent, in background running public services to the actual exchange of data to bring services to life. To do so, these services could leverage a cross-organizational digital identity of citizens or corporations, or constant and organized data exchange to initiate public services independently without the “client's” conscious input (Scholta et al., 2019).

Starting points for collaboration of public administrations can differ, acknowledging the diverging set of tasks horizontally and the potential vertical differences of, for example, federal states (Bogumil & Jann, 2020) with fewer contacts to clients and varying client portfolios. E-government approaches of public administrations are, therefore, likely to differ. Ambitious approaches to strengthen e-government capacities can require digital transformation programs that not only encompass changes to processes but also require attention to, for example, cultural, political, and organizational aspects (Borucki & Oswald, 2020). These multiple aspects should be orchestrated carefully and not treated individually.

Practitioners and scientists are showing increasing interest in the use of IT for public administrations. In Germany, for example, interactions with public administrations are still characterized by on-site appointments (Martini, 2018), and non-public stakeholders continue to be dissatisfied with national e-government offerings (Initiative D21 & fortiss, 2017; Initiative D21 & Technische Universität München, 2021), which they primarily use for information purposes (Martini, 2018). Part of the reason for this deficit is the lack of an aligned, strategic goal when it comes to picturing the role of a digitalized public administration within a network of stakeholders (Deckert, 2019). In summary, there is sufficient room for improvement compared to what is claimed to be achievable with e-government.

Governments and public administrations are trying to fill this gap with new legislation or adjustments to existing legislation. In Germany, the implementation of the “Act to Improve Online Access to Administrative Services” (BMI, 2020) is an ongoing effort to digitalize public services on all federal levels. This effort demonstrates that IT implementations do not necessarily take into account fundamental organizational changes (Mergel, Kattel, Lember, & McBride, 2018; Schmid, 2019) needed to achieve a higher e-government maturity level. High e-government maturity levels require more than just a definition of public government as a digital stakeholder (Möltgen-Sicking & Winter, 2018). They also demand a holistic approach across involved stakeholders (Misgeld, 2018), including a digital infrastructure that takes into account the resulting challenges of data management and data privacy with respect to strict EU legislation (Möltgen-Sicking & Winter, 2018; Yamamoto, 2019). Finally, the realization of such an ambitious journey is a call for practitioners and scientists to rethink the fundamentals of existing structures in and outside public administrations (Brunzel, 2017).

2.2 Blockchain, prominent concept of distributed ledger technologies

This section introduces the domain of distributed ledger technologies (DLT), including blockchain. It overviews the multiple DLTs and highlights perceived potentials and questions of stakeholder involvement.

2.2.1 Conceptions

DLT represents a database "that is stored and maintained on multiple computing devices, and each of these 'nodes' replicates and saves an identical copy of the ledger" (Manski & Bauwens, 2020, p. 2) independently from any centralized administration (Momot, Tumietto, & Teslenko, 2018). The multiple DLT designs, such as Ethereum or IOTA, offer features that include transparency, traceability and security (El Ioini & Pahl, 2018). These features are enabled by a combination of well-known technologies (El Ioini & Pahl, 2018): distributed peer-to-peer-networks, consensus mechanisms, and public key cryptography (Ziolkowska, 2021).

Emergence of post-blockchain DLT

Blockchain is only one DLT, and both terms are sometimes used interchangeably (Bashir, 2018). However, blockchain evolved first, in 2008, and is the most well-known DLT with its prominent application of Bitcoin. Since then, other DLT designs have emerged in response to the limitations of blockchain, such as high operational costs, high latency, and low transaction throughput. These limitations hinder implementation (Palm, 2019). Even the evolution from the Bitcoin to the Ethereum blockchain, introducing automatically executed, pre-configured code ("smart contracts"), did not render these limitations obsolete (Chiu & Lim, 2020). Consequently, alternative DLT designs focus on eliminating these limitations, thereby enabling new use cases (Palm, 2019).

While each DLT design offers a unique composition of characteristics, the individual characteristics can partly overlap with other DLT designs (Kannengießer, Lins, Dehling, & Sunyaev, 2020). Nonetheless, each DLT design can lead to diversifying "data structure, fault tolerance and consensus approaches" (El Ioini & Pahl, 2018, p. 277). Because of the differences between DLT designs, selection becomes an important decision. Kannengießer et al. (2020) argue that once a technical solution has been implemented on one DLT design, switching to another DLT design appears complex.

DLT landscape at a glance

As outlined above, there are different concepts and designs of DLT. Kannengießer et al. (2020) offer a logic to structure these various forms of DLT. Table 2 presents an overview of the structural elements.

Table 2: Overview of DLT structural elements

Source: Kannengießer et al. (2020)

DLT structure element	Description	Element example
Concept	"DLT concepts describe the basic structure and functioning of DLT designs on a high level of abstraction" (Kannengießer et al., 2020, p. 3).	Blockchain; Sidechain
Design	A DLT design belongs to one concept and is distinctive from other designs through a unique set of properties.	Ethereum; IOTA
Property	Properties represent a group of characteristics. One property could be applicable to multiple concepts. It is the combination of properties which constitutes the add-value.	Security; Performance
Characteristic	Characteristics are either technical (e.g., block size or maximum number of transactions per second) or administrative features (e.g., validator nodes for sidechains) of DLT designs.	Immutability; Throughput

To differentiate the four DTL concepts, it is necessary to understand the basic architectures of DLT, namely public and private architectures (Beck, Müller-Bloch, & King, 2018; O'Reilly, 2011). Whether a DLT solution is considered public or private depends on whether a user is allowed to participate in the DLT network to "execute the consensus protocol [or] maintain the shared ledger" (Jayachandran, 2017). While transactions can be seen and sent by anyone in a public DLT setting, this is only allowed to authorized users in a private DLT setting (Hellwig, Karlic, & Huchzermeier, 2020). If a group of organizations manages a private network, the solution is referred to as “consortia” or “federated” (Momot et al., 2018). Additionally, public networks usually require incentive mechanisms to motivate unknown stakeholders to use the computational power to validate blocks or transactions (Kannengießer et al., 2020). Finally, when selected participants are granted more privileges than others, the DLT solution is called “permissioned,” while an equal distribution of rights is “permissionless” (O'Reilly, 2011).

The concepts of DLT

Many DLT designs are already in place, and each can be assigned to one of four DLT concepts (Figure 1). First, the concept of blockchain utilizes one universal chain of linked blocks (Manski & Bauwens, 2020). The concept of one chain of blocks increases the immutability in general (El Ioini & Pahl, 2018) because an attempt to change one block would require all other blocks to be updated simultaneously. One block can consist of one or multiple transactions and is added to the last block in the chain when generated. Prominent example blockchain designs are Bitcoin, Ethereum or Hyperledger Fabric.

The second concept, sidechain, is based on blockchain’s concept of linked blocks. In contrast to blockchain, however, sidechain envisages the use of multiple connected blockchains (Singh et al., 2020). Local transactions are handled in individual private blockchains, the sidechain. Sidechains are connected to a consortia blockchain, sometimes referred to as “parent chain” (Worley & Skjellum, 2018) that exchanges transactions with a sidechain. Validator nodes connect the consortia blockchain with the sidechain. The split into multiple blockchains can be beneficial, for example, when a sidechain is used for one specific use case with a defined set of stakeholders (El Ioini & Pahl, 2018).

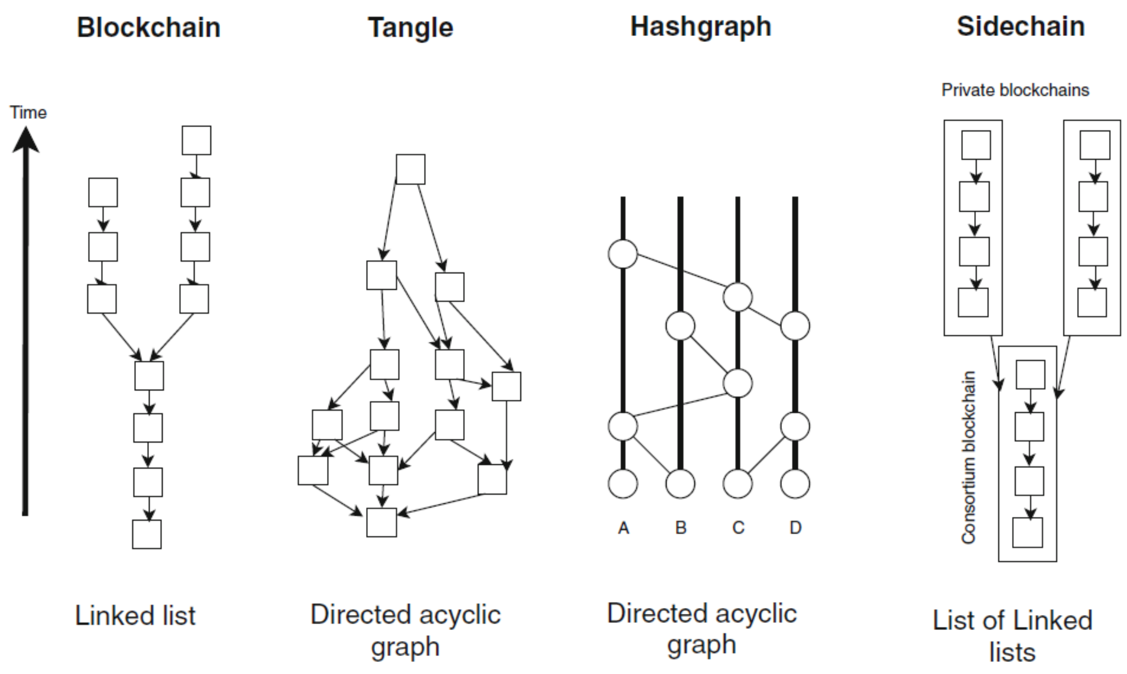

Figure 1: Overview of DLT concepts

Source: El Ioini and Pahl (2018)

Tangle, the third concept, leverages directed acyclic graphs (DAG) to structure data treelike (Treiblmaier, 2020). Consequently, one transaction or block "can have multiple predecessors" (Lange et al., 2019, p. 50). Also, and in contrast to blockchain-based concepts, it is possible to build clusters of nodes which do not hold the fully replicated transaction history. This allows the processing of large volumes of transactions or blocks per second (El Ioini & Pahl, 2018). Depending on whether the respective tangle design leverages blocks or transactions for its network, a distinction is made between BlockDAG for block-directed DAGs and TDAGs for transaction-directed DAGs. Due to this characteristic, tangle is especially relevant for applications around the Internet of Things (Kannengießer et al., 2020).

Hashgraph is the fourth DLT concept. Similar to tangle, it uses DAG as a data structuring method (Akhtar, 2019) and combines it with the gossip consensus mechanism. In short, gossip refers to the information about a transaction which is sent from one node to another, which is selected randomly. The receiving node then sends it to another randomly selected node until all available nodes in the network have received information about the transaction (Baird, 2016). This consensus algorithm is characterized as being fair in that the first transaction is validated first (El Ioini and Pahl, 2018) and allows a high throughput (Treiblmaier, 2020).

2.2.2 The relevance of the technology and stakeholders

The perception of values and limits of DLT, and blockchain in particular, varies considerably among scholars (Lange et al., 2019). However, many experts tend to highlight exciting potentials and ascribe a disruptive character to DLT (Lianos, 2019). For example, they place DLT on the same level of importance as the Internet (Ziolkowska, 2021) or foresee drastic changes to societies, economies, and their members (Chiu & Lim, 2020; Lianos, 2019).

These assumptions rest on the belief that DLT can transform stakeholder interactions (Rohr & Wright, 2019) by providing new forms of cooperation and governance (Manski & Bauwens, 2020; Treiblmaier & Sillaber, 2020). Gstrein and Kochenov (2020) predict, comparably diffident, that DLT might increase the efficiency of public services. As a result, DLT could strengthen the trust of non-public stakeholders in public institutions (Treiblmaier & Sillaber, 2020).

The number of DLT solutions increases steadily within domains such as finance, health care, or supply chain management (Kannengießer et al., 2020), trying to prove their capabilities (El Ioini & Pahl, 2018). Still, Baldacci and Frade (2021) conclude that blockchain's current capabilities do not reach the high expectations. They offer a twofold argument: First, the elimination of intermediaries, often associated with DLT, might not mean striving for decentralization. Second, the public sector is perceived to be a suitable case to investigate public services to non-public stakeholders (Baldacci & Frade, 2021). This reflection of today's situation follows "a natural path for every technology" (Psarrakis, 2021, p. 17) whereby the perceived use and value change over time.

Changing relationships

As outlined, the use of DLT should enable new ways of organization and cooperation. This points to potential effects on inter-organizational relationships, which can be located at the organizational (Beck et al., 2018) and technical level (Treiblmaier, 2020).

On an organizational level, the use of DLT often promises to eliminate third parties and strengthen peer-to-peer relationships. More preciously, DLT is said to facilitate "trustless" direct relationships (El Ioini & Pahl, 2018), whereby stakeholders need not trust each other for any transactions (Treiblmaier, 2020). Trust is not obsolete, though. It shifts to the technical level (Walch, 2019). The same stakeholders have to trust the DLT solution and its architectural features instead (Berg, Berg, & Novak, 2020; Ølnes & Jansen, 2021). This highlights the importance of focusing on both the organizational and the technical level and their interrelations.

The technical level is complex—especially regarding its stakeholder relationships. This is particularly relevant for public DLT when network participants, such as nodes operators, are most likely unknown and could be spread out internationally (Baldacci & Frade, 2021; Ølnes & Jansen, 2021). Hence, a regionally used business solution could rely on international or other organizational stakeholders in potentially different jurisdictions (Zwitter & Hazenberg, 2020) and with diverging interests, on a technical level, depending on the setup of the DTL network.

Decentralized stakeholder influence

Rearranging organizational relationships, making intermediaries obsolete, and shifting responsibilities toward technology are complex transformations that can, for example, impact behaviors or change underlying assumptions for legislation (Zilgalvis, 2021). The consequences of these fundamental transformations should not be underestimated. However, Fischer and Valiente (2021, p. 4) observe a bias among advocates of DLT to deliberately "ignore all questions of norms and culture and equate governance entirely with coded procedures." Especially when applied to matters of social governance, awareness of risks and issues associated with DLT should receive proper attention (Wang et al., 2020).

Some scholars argue that the changing stakeholder landscape goes along with shifting power relations (Chiu & Lim, 2020). Established organizations are challenged by other, tech-related stakeholders or algorithms that can independently make decisions affecting the (public) services of the respective organization (Chiu & Lim, 2020). The introduction of DLT gives rise to new stakeholders and roles, who exist not only in digital realms but also in person (Zwitter & Hazenberg, 2020). For example, the Ethereum organization is behind the homonymous DLT design. Situated in a particular jurisdiction and run by only a few people, this organization decides on general directions of development and, thereby, obtains powers from this privileged position. Operators of nodes in the Ethereum network are spread globally and decide independently which block to validate or which decisions to make in case of any voting.

Powerful stakeholders in DLT networks are not necessarily large companies, they could also be small interest groups (Zwitter & Hazenberg, 2020). Thus, while the DLT may realize a decentralized network, the power may still be centralized (Ølnes & Jansen, 2021). This is similar to recent developments in cloud computing (Lianos, 2019) where only a few large companies, for example, Microsoft or Amazon, dominate the cloud computing market (Statista, 2021). Matters of stakeholder relations and corresponding shifting or centralized powers do not only affect the immediate blockchain solution as provided by the Ethereum organization, for example. Moreover, these matters concern the entire blockchain ecosystem (Finck, 2019), include higher (e.g., decentralized apps) or lower technical levels (e.g., network infrastructures). Consequently, governance systems that handle the interplay of involved stakeholders are important for DLT (Lianos, 2019) and need to define arrangements that organize competing and cooperating stakeholders (Stötzel, 2020).

The governance in a blockchain network, the most relevant DLT concept, can be organized on-chain or off-chain (Fischer & Valiente, 2021). On-chain governance refers to the use of coded algorithms within the DLT, which enable a voting functionality, whereby relevant stakeholders, such as miners or node operators, can vote on changes to the blockchain design. This is opposed to off-chain governance, which refers to decision-making processes outside the blockchain network (Fischer & Valiente, 2021), for example, bilateral communications.

The influence and potential impact of stakeholders is not a theoretical gameplay. Recent cases such as the successful 51% attack on Ethereum (Rodgers, 2019) or the expensive not met investor expectations of Tezos (Hacker, Lianos, Dimitropoulos, & Eich, 2019), demonstrate empirical relevance. Hence, the field of blockchain governance should not be ignored (Berg et al., 2020). In the same way, the Council of Europe calls for further attention to technology-related power shifts in societies and in relations between state and society (Bendiek & Neyer, 2020).

2.3 Current state of research

DLT and its concept of blockchain already receive significant attention among scholars (Kannengießer et al., 2020). The work of practitioners has also increased. Nonetheless, blockchain is still perceived as being in its early stages, considering that only limited scholarly work has been published by 2016 (Butijn, Tamburri, & van Heuvel, 2020).

Today, there is constant scientific discussion on blockchain (Sobolewski & Allessie, 2021) and the concrete benefits and impact it might have (Chiu & Lim, 2020; Manski, 2020). Blockchain is sometimes described as a revolutionary technology (Bashir, 2018). Early works pointed to a disruptive potential to roles of governments (Sobolewski & Allessie, 2021) and nation states (Risius & Spohrer, 2017), while other scientists expect rather modest, evolutionary impacts (Bashir, 2018). Critics of the technology may agree to the wide-ranging potentials but also "call for careful evaluations" (Risius & Spohrer, 2017, p. 397) if the promises of blockchain hold true or rather favor the generation of power elites and lead to weaker societies. Consequently, there is a need for research that supports public institutions in their quest for thoughtful decisions regarding blockchain by, for example, understanding the actual limitations and realistic benefits (Risius & Spohrer, 2017).

Application of blockchain

Blockchain offers a growing number of implementations compared to other DLT (El Ioini & Pahl, 2018). These involve implementations for general purposes as well as for specific domains—financial and business, in particular (Sobolewski & Allessie, 2021), but also the public sector. The interest in the latter is increasing with public stakeholders in hopes of efficiency improvements or relationship changes with citizens (Sobolewski & Allessie, 2021). Well-known applications in this domain can be seen in countries such as the United Kingdom with a "Blockchain as a Service" approach, Georgia with respect to land registries, or Estonia offering e-voting (Momot et al., 2018).

Scientific works focus on the same domains, including e-government (Butijn et al., 2020), and contribute to a field of research still aiming to understand the potentials of blockchain and other DLT (Kannengießer et al., 2020; Zilgalvis, 2021). For example, Atzori (2018) elaborates on the necessity of trusted entities that might be relevant for public services in response to the use of blockchain. His effort, nonetheless, does not adequately stress the specifics of the public sector. Additionally, Reddick, Rodríguez-

Bolívar, and Scholl (2021, p. 3) present a collected edition which seeks to highlight the combination of blockchain and the public sector and related "theories, reforms, and case studies." While the contained contributions partly examine real-life implementations and partly provide theoretical and technical insights, none of them offer a holistic view on blockchain-based public service delivery.

Lemieux and Bravo (2021) assert that these works often concentrate on technical aspects while at the same time observing a growing interest in research about the social and political potentials of blockchain. Nevertheless, these works are mostly conceptual and often lack an evaluation of "blockchain's impact on public governance and administration" (Treiblmaier & Sillaber, 2020, p. 228) and the possibility to replace its structures (Rueda, Šaljić, & Tomić, 2020). Further research on the technological and institutional perspectives of this technology is required, particularly with respect to public administrations (Ølnes, Ubacht, & Janssen, 2017). This research is necessary to avoid unrealistic expectations and understand potential risks for society associated with a technology scale-up (Gstrein & Kochenov, 2020).

An evaluation of real-life use cases with respect to how blockchain conquered contemporary problems seems valuable (Treiblmaier & Sillaber, 2020). This evaluation might be hindered because many implementations are still in early phases of development (Manski & Bauwens, 2020). These rather young implementations and the perceived immature technology of blockchain, consequently, make evaluations concentrating on long-term effects unlikely (Treiblmaier, 2020; Ziolkowska, 2021).

The academic research is also relevant for the governance of blockchain. It started to develop in 2016 with respect to challenges of governance of blockchain. Academic literature remains scarce, however. Literature in this field "still comprises mostly blog post and social media entries" (Fischer & Valiente, 2021, p. 4) of questionable quality. Van Engelenburg et al. (2020) assert a missing framework which could allow an assessment of relationships and stakeholder interests within blockchain networks. This assessment should consider the multiple stakeholders, such as miners or developers (Ølnes & Jansen, 2021), whose potential power asymmetries are perceived as a challenge (Butijn et al., 2020; Stötzel, 2020).

Empirical deficits

Although the potentials and risks of blockchain technology have already been discussed within the academic community, these efforts are often future-oriented (Hacker et al., 2019; Sobolewski & Allessie, 2021) and remain conceptual with respect to the public sector (Risius & Spohrer, 2017) and the societal aspects (Sobolewski & Allessie, 2021). Moreover, little evidence on blockchain's impact and its value for the public sector links the conceptual discussion with empirical observations of real-life implementations (Batubara et al., 2018).

Consequently, multiple scholars argue for more empirical work (Batubara et al., 2018). This work should validate the theoretical body of knowledge on blockchain by investigating existing implementations (Ølnes et al., 2017; Risius & Spohrer, 2017). This is relevant because reflections on fast pacing technologies are important for affected stakeholders to understand associated consequences. However, this reflection often lags behind (Ritzi & Zierold, 2019). Hence, an investigation should consider if and how blockchain design and application tackle the needs and, thus, raises new questions beyond technology. The nature of such investigation within a multidimensional setting (Ziolkowska, 2021) requires a multidisciplinary research approach encompassing not just information systems but also, for example, political and social sciences (Risius & Spohrer, 2017). Multidisciplinary empirical research could support public administrations in their search for ways to master challenges by benefiting from academic work that draws on lessons learned from existing use cases. Such work is scarce to date (Treiblmaier & Sillaber, 2020).

Case studies are well-known within information systems and could contribute to filling the empirical gap. They represent a "suitable approach to systematically transfer industry experience into research agendas which benefit both theory development and testing as well as design science research" (Treiblmaier, 2020, p. 1). However, theory-driven empirical research on blockchain is perceived as rare (Risius & Spohrer, 2017) leaving out the opportunity to combine theory and empirical observations (Ridder, 2017).

In summary, the current state of research shows the need for further research and offers starting points for this dissertation, which are summarized in Table 3.

Table 3: Summary of starting points for potential contributions of this dissertation

#	Starting points for potential contributions of this dissertation
1	Understanding of the actual limitations and realistic benefits of blockchain is vague.
2	Existing works on blockchain are mostly conceptual and do not link with empirical observations of existing implementations.
3	Evaluation of blockchain's impact on public governance and administration is lacking.
4	The framework to assess relationships and stakeholder interests within blockchain networks is missing.
5	Current evaluations seem insufficient to determine if the promises of blockchain hold true or merely favor the generation of power elites, leading to weaker societies.
6	Case studies are scarce but could contribute to filling the empirical gap.

The starting points can serve as orientation for this dissertation’s articles supporting the current scientific discussion. The objective and research questions of the dissertation pick up these starting points accordingly (Figure 2).

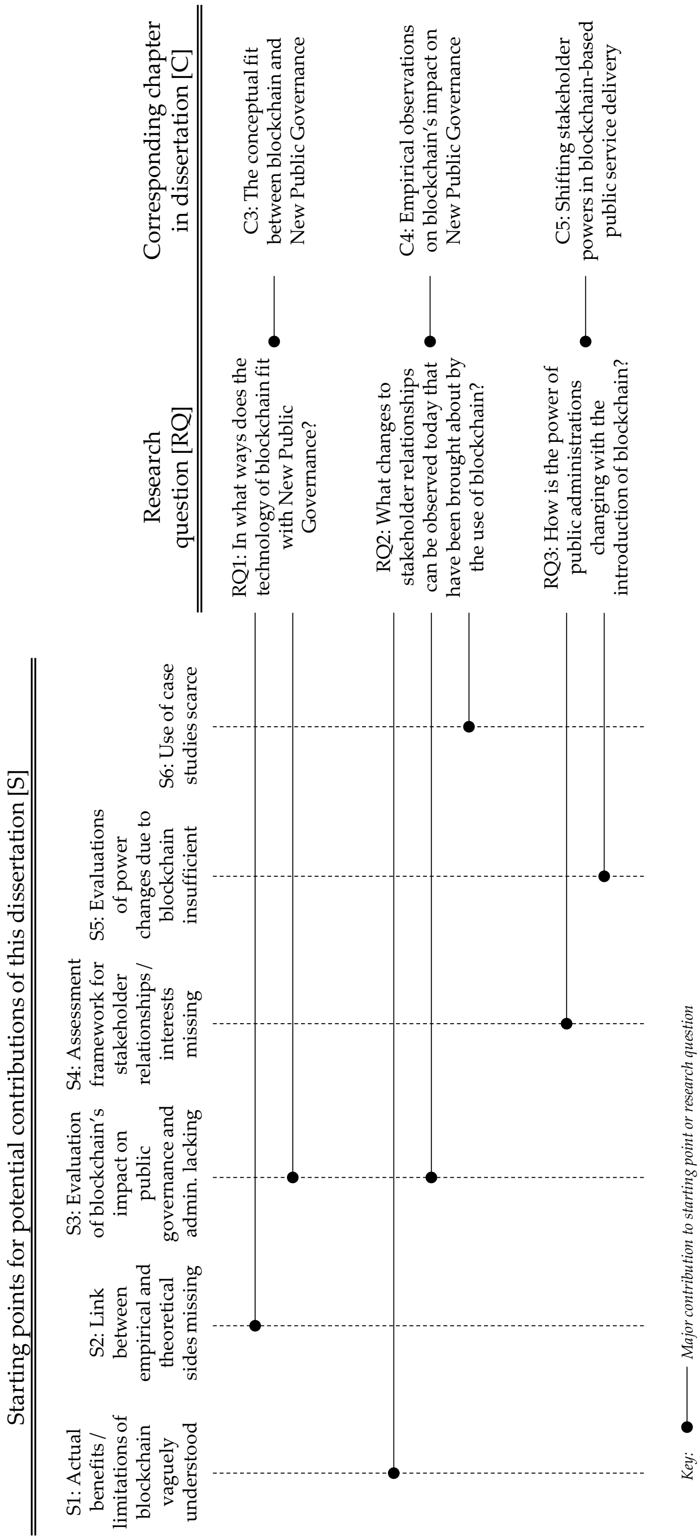

Figure 2: Relationship between starting points from current state of research, research questions, and chapters

3. THE CONCEPTUAL FIT BETWEEN BLOCKCHAIN AND NEW PUBLIC GOVERNANCE

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Note: The numeration of figures and tables was adjusted to ensure proper identification throughout this dissertation. No changes to content were made in the context of these adjustments.

3.1 Abstract

Collaborative public service delivery and blockchain are perceived as important themes for the development of public services. Thus far, each topic has generally been discussed separately. This paper seeks to theoretically and empirically substantiate the conceptual benefits and limitations of using blockchain to enable the paradigm of New Public Governance (NPG). Therefore, a case-based comparison and a subsequent Delphi-based evaluation are conducted to map the ideals of NPG against the accomplishments of an existing blockchain implementation. As this qualitative study demonstrates, blockchain can support public and nonpublic stakeholders in their efforts to create public services in co-producing networks. However, according to the findings of this research, the potentials differ and do not always meet the theoretical ideals of NPG; for example, while the use of blockchain supports a broad stakeholder inclusion at the process level as promoted by NPG, it may also lead to rather centralized control by a few key stakeholders at the technical level.

3.2 Introduction

Collaboration across public and nonpublic stakeholders is considered to have great potential for the delivery of public services. New Public Governance (NPG) addresses this aspect theoretically and promotes a focus on co-producing public services (Liddle, 2018; Osborne & Radnor, 2016; Pestoff, 2012).

According to Rodríguez Bolívar (2018), it is not a novelty that IT can support participative governance and play a significant role in society. The researcher outlined a far-reaching vision in which technologies are used to enable organic, virtual, and leaderless interactions between public administrations, NGOs, and private companies. In particular, the potential to rethink the composition of public administrations is being attributed to blockchain (Reijers, O'Brolcháin, & Haynes, 2016). Distributed ledger technologies (DLTs), particularly blockchain (cf. Section 3.1), have already received a great deal of attention from scientists and practitioners concerned with the public sector because they are expected to have great potential for increasing trust in interorganizational relationships (Smits & Hulstijn, 2020) and efficiency in public service delivery (Batubara et al., 2018). However, various other sectors such as health care and financial services have also shown interest (Paulavičius, Grigaitis, Igumenov, & Filatovas, 2019). Some scholars have even argued that blockchain could be leveraged in the fight against the ongoing COVID-19 crisis (e.g., Kalla, Hewa, Mishra, Ylianttila, and Liyanage (2020)). This potential of blockchain is said to be facilitated by the following three factors: distributed data, peer-to-peer data exchange, and the immutable storage of data (Dapp, Balta, & Krcmar, 2017).

In addition, the use of blockchain is associated with opportunities for transformation. If information can be maintained in a decentralized system that cannot be manipulated, then intermediaries, such as the authorities that keep the registers, could possibly be dispensed with. Varying appraisals have been made of the degree of transformation that may be possible. One distinctive feature addressed in these appraisals is the role public administrations will play when leveraging blockchain. Some practitioners and scholars have advocated for the chance to eliminate the established role of public administrations as intermediaries (e.g., Pignatelli, Allessie, Sobolewski, and Vaccari (2019)). Other scholars perceived the use of blockchain as a chance to implement efficient end-to-end processes across institutional boundaries and without media discontinuity (Dapp et al., 2017), thus directly linking blockchain users.

To date, numerous implementation challenges have been observed for both the former and latter positions. Dapp et al. (2017, p. 1) asserted that challenges concerning “technology, processes, law and personnel” in the use of blockchain in institutions must be tackled. However, this argument underestimates the interorganizational and societal perspective; that is, the large-scale use of blockchain would require mature degrees of self-organization by the parties involved in a blockchain-enabled community.

In conclusion, current scientific discussions demonstrate a lack of a holistic understanding, which hinders effective discussions of the development of public administrations. Therefore, an interdisciplinary approach that relates studies on public administrations to the concept and existing implementations of blockchain is required. Only a few studies have attempted to explicitly fill this gap between blockchain and studies of public administration, and these have largely focused on practice. Hence, the present study argues in favor of additional research "to position [the benefits of blockchain] in a more realistic view which takes into account both technical and institutional elements" (Ølnes et al., 2017, p. 358). The main of the present research is to identify the potential contributions that blockchain could make to NPG.

The results of the present research demonstrate blockchain's ability to support new collaborative working modes of public governance and simultaneously reveal constraints and dependencies in connection with blockchain governance. The remainder of this article is structured as follows: Section 2 elaborates on the roots and essentials of NPG, especially the collaborative aspects of the concept. Then, Section 3 briefly explains blockchain technology before examining two aspects of blockchain governance, namely governance by and of blockchain (Ølnes et al., 2017). These two sections build the theoretical foundation and are followed by an explanation of this paper's methodology in Section 4, which presents an initial comparison of the theory with two existing use cases and the Delphi method subsequently employed for an expert survey. Sections 5 and 6 respectively present and discuss the individual and conjunct results of both the comparison and Delphi method. Finally, Section 7 provides the conclusion, including potential directions for future research.

3.3 New Public Governance

An increasing scientific focus on the management of interorganizational relations for delivering public services can be traced through the literature in recent years (Kekez, Howlett, & Ramesh, 2018; Wiesel & Modell, 2014). This governance-focused paradigm targets the formal and informal processes through which numerous stakeholders interact to govern society and the economy in accordance with common goals (Torfing & Triantafillou, 2016a). While managing an organization in the sense of New Public Management refers to markets, buyers, service providers, customers, and contracting parties, new stakeholders can be found in networks, partnerships, and civil leadership (Pestoff, Brandsen, & Verschuere, 2012). This paradigm is often referred to as NPG and can be perceived as the emancipation of public governance, which already plays a limited role within New Public Management. Public governance offers "ways in which stakeholders interact with each other in order to influence the outcomes of public choices" (Pestoff, 2012, p. 363). By placing a greater emphasis on collaborative modes of working and governance to deliver public services (Lecy, Mergel, & Schmitz, 2014), NPG seeks to address public issues more efficiently, with higher-quality and extended capacities. It relies on the competencies and ideas of public employees, citizens, businesses, and NGOs. For governance, NPG favors a "more integrative leadership and a trust-based management" (Torfing & Triantafillou, 2016b, p. 13).

The process of delivering public services in the spirit of NPG differs immensely from today's predominant approaches. The traditional "governmental chain" (Torfing & Triantafillou, 2016b, p. 11) perceives citizens and companies as recipients of government benefits, receivers of services, or regulated subjects. By contrast, public administrations within NPG are "only one player amongst many others" (Kennett, 2010, p. 20) within an interactive public service delivery system. Thus, the management of a co-produced public service, including planning and subsequent evaluation, becomes a significant challenge (Dale, Vella, & Potts, 2013; Torfing & Triantafillou, 2016a).

Collaborative governance is an integral part of NPG and “synergistically brings together knowledge, resources, skills and perspectives to deliver improved public services and public goods” (Ansell, 2016, p. 36). A distinctive feature is that network participants are interested either in joint delivery or the joint results of public services. Several fundamental principles are inherent to the meaning of collaborative governance and act as the foundation of collaborative problem solving. Based on a literature review, Table 4 summarizes these fundamentals and demonstrates that collaboration for jointly delivering public services is not only the core of NPG but also presents challenges and opportunities for bureaucracy

Table 4: Fundamental principles of Collaborative Governance

Principle (Torfing & Triantafillou, 2016a)	Brief description (Torfing & Triantafillou, 2016a)	Issues from the perspective of bureaucracy
Distributed action	Collaborative governance brings together various stakeholders with comparatively autonomous capacities. Citizens or companies contribute their knowledge, network, or other resources to the production of public services. The collaboration is voluntary, and thus, mutual agreement is of considerable importance when collaboration occurs. This implies that decisions are not simply imposed on stakeholders.	The influence and dominance of external actors on the basis of individual agendas (Rigg & O'Mahony, 2013) Equal chances to participate (Brink & Wamsler, 2018) Limited democratic control (Watson, Deeming, & Treffny, 2009)
Jointness	These stakeholders work together for the purpose of jointly delivering services and products. This requires coordination effort, which is likely to increase with a growing number of participating stakeholders.	Reduction of public accountability (Watson et al., 2009)
Self-production	Self-production aims to allow the direct contribution of an individual stakeholder to collaborations with others, which requires both citizens and companies to be empowered to do so.	More responsibility through the loosening of the hierarchical order (Torfing & Triantafillou, 2013)

Principle (Torfing & Triantafillou, 2016a)	Brief description (Torfing & Triantafillou, 2016a)	Issues from the perspective of bureaucracy
Consensus orientation	The consensus orientation between stakeholders is obviously related to the abovementioned principle of voluntariness. However, this is also essential for countervailing the lack of an overall authority and enabling the pursuit of a joint solution.	Effort and required time (Dickinson & Glasby, 2010)
Deliberation	Collaboration does not occur in a vacuum. Rather, it is the result of a multilateral, bidirectional process of alignment between acting stakeholders. The degree of formalization for this alignment can vary.	Documentation and transparency/ traceability (Ansell & Gash, 2007)
Consequential decision-making	Decisions taken must then be implemented. This implies that controlling mechanisms are in place to ensure that the intended purpose is achieved.	Measurability of the outcomes (Rogers & Weber, 2010)

Stakeholders rely on each other to deliver co-produced public services (Pestoff et al., 2012). They and their organizations rely on the principles of social interaction, namely "implementing peer-production, peer trust, peer-review, and peer-vote mechanisms for decentralized communication and decision making" (Rychkova & Zdravkovic, 2017, p. 114). This implies the existence of shared and applied norms and values. The consideration and implementation of such principles appear vital given the underlying fact that interactions within NPG are of a voluntary nature. Securing the motivation of voluntarily acting parties (Rychkova & Zdravkovic, 2017) and then having them reach a consensus are challenging and fundamental tasks.

Technology supports this participatory manner of working and has gained increasing attention in recent years. E-voting or e-petition solutions, for example, are already contributing to more efficient decision making among stakeholders. Furthermore, hackathons or ideation forums are conducted by public administrations to leverage nonpublic resources (Le Blanc, 2020), such as competencies and experience. Additionally, open government data initiatives seek to provide greater transparency and traceability to public action or to offer opportunities to nonpublic stakeholders for exploiting public data (Attard, Orlandi, Scerri, & Auer, 2015). The latter is referred to as part of open government. The concept of open government seeks to reinvent the relationship between public administrations and their stakeholders (Hilgers & Ihl, 2010). This can generally be linked to the overall approach of NPG. Open government aims to improve "the abilities of democratic societies to deal effectively, sustainably, and equitably with its issues" (Lathrop & Ruma, 2010, p. 94). Measures include increasing transparency toward citizens (Kok, 2018) and allowing them to co-create (Kornberger, Meyer, Brandtner, & Höllerer, 2017). For this purpose, open government initiatives are increasingly linked with the use of technological tools (Amadi & Igwe, 2018) such as open data portals. However, initiatives are not necessarily limited to the digital realm and its technological implications. In fact, challenges in electronic participation continue to exist due to the conceived "heavy focus on technology aspects, to the detriment of aspects of organizational change in public institutions and broader socio-technological considerations" (Le Blanc, 2020, p. 17). Now, blockchain may be a new technological opportunity to support the realization of NPG.

3.4 Blockchain

This section sets out the foundations of blockchain technology. In particular, it highlights the key functional characteristics of blockchain before providing an overview and explanation of the distinction between governance by and of blockchain in preparation for this study's analysis.

3.4.1 Definition and application

Blockchain is a well-known example of a DLT. Such technologies distribute an electronic ledger across a network (Chowdhury et al., 2019) and in a peer-to-peer manner (World Bank, 2017). This study considered blockchain for two main reasons: First, blockchain represents the most popular DLT (Howell, Potgieter, & Sadowski, 2019; Suciu et al., 2018), with Bitcoin and Ethereum being two wide-spread specializations. DLTs also partly represent even younger technologies, which – in contrast to blockchain – seem to lack significant empirical evidence for the public sector. Second, the technical characteristics of other DLTs partially differ from blockchain; for example, Corda does not necessarily emphasize decentralization, and IOTA does not leverage an entire network of nodes for consensus building, only small groups (Alastria, 2020). These differences could have potentially led to diverging outcomes for the present research.

Like other DLTs, blockchain can support the secure transfer of any kind of digital asset (e.g., intellectual property or contracts). Although a general definition has not yet been acknowledged among researchers (Seebacher & Schüritz, 2017), blockchain can be considered a trustworthy electronic distributed ledger that contains transactional data stored within a network of participating nodes (Yli-Huumo, Ko, Choi, Park, & Smolander, 2016). This distributed ledger is transparent to every node. This transparency and the consistent use of predefined code, also referred to as "smart contracts," offer great potential for standardization and automation (Seebacher & Schüritz, 2017).

There are two major blockchain architectures, namely public and private architectures (Beck et al., 2018; O'Leary, 2017). The major difference involves the question of "who is allowed to participate in the network, execute the consensus protocol and maintain the shared ledger" (Jayachandran, 2017). In public blockchains, transactions are visible to and can be sent by anyone, whereas in private blockchains only a predefined number of nodes are allowed to participate (O'Leary, 2017). Sometimes, the preselected organizations that operate authorized nodes in a private blockchain are referred to as a "consortium" (Buterin, 2015). When every participant has the same privileges, as is the case for Bitcoin, such a blockchain is referred to as permissionless. If some participants have more privileges than others, such as restrictions concerning who can view transactions, such a blockchain is considered permissioned (O'Leary, 2017). Careful differentiation between the potential architectures is required because they influence the degree of immutability. For example, private blockchains may be easier to tamper with than public ones (Zheng, Xie, Dai, Chen, & Wang, 2018) due to the limited number or preselection of nodes.

An outstanding advantage of blockchain is the ascribed potential immutability of data stored within the network (Yli-Huumo et al., 2016). Consensus mechanisms are leveraged to validate transactional data before they are added to the ledger as new blocks – or rather added to the chain of blocks (Dapp et al., 2017; Ølnes et al., 2017). The transparency and high immutability support the traceability of data with the blockchain network (Ølnes et al., 2017), which could lead to a high degree of security, reliability, and certainty for nodes and network users (Beck et al., 2018).

3.4.2 Functional characteristics

Several characteristics are attributed to blockchain. A large body of literature already lists such characteristics (Campbell-Verduyn, 2018b; Dapp et al., 2017; Seebacher & Schüritz, 2017). Zheng et al. (2018) presented an overview of the major functional characteristics, which are persistency, decentralization, anonymity, and auditability. It is crucial to differentiate functional from technical characteristics because the technical characteristics can promote or lead to the functional characteristics. For example, the use of cryptography and hashing functions as technical characteristics support the perception of blockchain as persistent (Filippi & Mcmullen, 2018).

Persistency, the first functional characteristic of blockchain, is a key characteristic that should protect data against manipulation once added to the ledger (Pignatelli et al., 2019). Decentralization, the second functional characteristic, refers to blockchain not representing a central entity but rather enabling the decentralized use and exchange of data in the sense of a peer-to-peer network (Seebacher & Schüritz, 2017). Anonymity, the third functional characteristic, refers to the identity of users being "covered by pseudonyms," and thus, "a high degree of privacy for [the users] is enabled" (Seebacher & Schüritz, 2017, p. 15). Lastly, auditability is a key functional characteristic of blockchain as stored blocks (i.e., data entries) can be accessed and traced by users at any time through the use of timestamps (Finck, 2019; Zheng et al., 2018).

3.4.3 Current state of research

Blockchain is a trending topic among scientists concerned with IT (Bedin, Queiroz, Capretz, & Hydro, 2020). Considering this rather new technological development, it is not surprising that public administrations and companies alike are engaging with blockchain intensively to better understand its value. "Governments from all over the world are conducting pilots" (Ølnes et al., 2017, p. 357) and businesses are attempting to better understand the value of blockchain for their enterprises (Koster & Borgman, 2020; Seebacher & Schüritz, 2017). Although the benefits are assumed to be manifold, discussions around blockchain largely focus on cryptocurrencies (Beck et al., 2018; Smetanin, Ometov, Komarov, Masek, & Koucheryavy, 2020; Yli-Huumo et al., 2016) and their technological, financial, and legal aspects (Atzori, 2015; Campbell-Verduyn, 2018a). Furthermore, some literature tends to focus on the "immense possibilities on one side and technology issues on another" (Ølnes et al., 2017, p. 355), but the issues that lie in between, such as implementation and governance aspects, are neglected (Howell et al., 2019).

The present study argued that blockchain-based governance still requires considerable academic discussion (Campbell-Verduyn, 2018a; Howell et al., 2019; Koster & Borgman, 2020; Lumineau, Wang, & Schilke, 2021). In a rare effort, Lumineau et al. (2021) linked blockchain to selected fundamental concepts of governance, especially relational and contractual governance. Nevertheless, an academic holistic view of and structured approach to how blockchain could contribute to future perspectives of public governance on a broad scale seem to be lacking.

Because these governance-related matters have received little research attention, the question of whether blockchain gives "rise to new governance problems and pathologies" (Campbell-Verduyn, 2018b, p. 4) remains unanswered. Therefore, a better understanding of blockchain governance is required (Beck et al., 2018; Campbell-Verduyn, 2018a; Koster & Borgman, 2020).

3.4.4 Aspects of blockchain governance

Two types of governance need to be distinguished with respect to blockchain: namely governance *by* and governance *of* blockchain. The first type refers to blockchain as an enabler of governance, whereas the second type addresses the principles of how to operate and use the technology (Ølnes et al., 2017). Despite this differentiation, governance ultimately deals with questions regarding the decisions to be made, the accountability for those decisions, the way they are made (Beck et al., 2018; Klischewski, 2018; Rychkova & Zdravkovic, 2017), and how to ensure that strategic goals are met (Rychkova & Zdravkovic, 2017).

The new institutional approach

Blockchain is considered an institutional technology of governance (Campbell-Verduyn, 2018a; Dapp et al., 2017, p. 1; Davidson, Filippi, & Potts, 2016a). Institutional technologies such as blockchain are considered advantageous when the public is able to "increase trust, lower transaction costs and improve the efficacy of economic coordination" (Davidson et al., 2016a, p. 3). The most frequently stated institutional benefit of blockchain is the elimination of third parties within transactional processes, which makes the institutional innovation behind blockchain apparent (Davidson et al., 2016a). The institutional innovation aspect also receives the most attention in the present paper as it focuses on the potential of blockchain for public administrations considering NPG for their public service delivery.

Blockchain is often referred to as "trustless" (Davidson et al., 2016a), but this is misleading. It appears correct to say that trusted data are no longer ensured or verified by an intermediate party (Davidson et al., 2016a). However, this does not mean that the issue of trust is solved simply through the use of blockchain. Rather, there is a shift in the question of whom to trust in order to trust data. The matter of trusted data becomes even more crucial for blockchain when multiple actors, as promoted by NPG, are expected to provide and rely on a single data source. Adequate measures appear necessary for ensuring the quality of data input and output. For example, Cappiello, Comuzzi, Daniel, and Meroni (2019) suggested relying on smart contracts as a tool for supporting data quality.

Within the blockchain environment, trust is ensured by two major determinants: the combination of technologies that form the concept of blockchain and the governance of the blockchain network. The first determinant refers to blockchain's technological characteristics, mainly the consensus mechanisms, data encryption, and automated execution of code (i.e., smart contracts). The second determinant, namely the governance of blockchain, is discussed among scientists primarily as – and is indeed reduced to – a question of how to design and operate a blockchain network. However, this seems neglected as a critical determinant of trust in blockchain-enabled business processes including data, because auditing this powerful line of code becomes crucial (Ølnes et al., 2017). This leads to two exemplary challenges in controlling blockchain (Klischewski, 2018): (1) Who should undertake this responsible task? (2) Who is accountable for the legal risks and obligations (Beck et al., 2018)?

Governance of blockchain

Institutional governance can be directly influenced by decisions regarding the technological governance of blockchains because the blockchain "implementation of a governmental process organizes information exchange and transactions between users" (Ølnes et al., 2017, p. 359). Therefore, to support governance *by* blockchain means being aware of the design options for the development, operation, and maintenance of the respective blockchain network. This includes the data, applications, and underlying infrastructure leveraged to physically run the network (Filippi & Mcmullen, 2018). For each of these architectural layers, questions regarding who can access it, who develops it, who owns it, and who controls it (Atzori, 2015; Ølnes et al., 2017) must be answered discretely.

Because public administrations are generally used to owning or controlling their IT services (Statista, 2020), these questions would be rather easy to answer today. With blockchain and the shift toward decentralization, however, finding sustainable answers (i.e., governance models) becomes far more complex. For example, the institutional relevance of the governance of blockchain is comparable to the use of cloud computing for public purposes. Similar to cloud computing (Salmon & Myers, 2019) or discussions on who may be able to affect 5G networks, geographical questions may play significant roles in the setup of blockchain environments: Where are the hardware and data hosted? Who runs the nodes? Who develops the applications? "Whoever owns and controls these platforms always have [sic] a significant power over civil society" (Atzori, 2015, p. 29). Blockchain may further intensify the discussion on the digital sovereignty of domestic public administrations as knowledge of and control over the IT components that depend on it (Posch, 2017) could be at stake.

Notably, whereas a large group of users could theoretically leverage the benefits of decentralized and personalized public services, a minority of people or interest groups could shape or alter the underlying blockchain architecture for their own good if it is not governed properly. For example, experiences with cryptocurrencies indicate that developers write the "organizational rulebook" (Hsieh, Vergne, & Wang, 2018, p. 51), which users and other stakeholders must then follow. Furthermore, if similar interests exist, it is likely that different parties (e.g., mining pools and service providers) could join forces and act as one interest group (Beck et al., 2018; Courtois, 2014). The blockchain platform Ethereum demonstrates that a blockchain organization needs to act with integrity and transparency (Atzori, 2015) and should be as independent of outside interests as possible (Campbell-Verduyn, 2018a). Atzori (2015, p. 27) described these IT professionals and organizations as privileged stakeholders in society who are "becoming the new policy makers." While this phrasing might be rather extreme, it rightly highlights the challenge of balancing powers in blockchain networks. Interestingly, NPG-based public service delivery faces a similar challenge, with power broadly distributed across multiple public and nonpublic actors (Torfing, Bøgh Andersen, & Greve, 2020). A more centralized or permissioned setup of blockchain networks may be seen as the obvious answer for reducing the number of influencers (van Dijk & Winters-van Beek, 2009). However, the following question remains: How much centralization is appropriate without putting the actual need for and benefits of blockchain at risk? Further blockchain research is required to answer this.

3.5 Methodology

The main of the present research was to identify the potential contributions that blockchain could make to NPG. To achieve this goal, empirical findings were leveraged that built on the theoretical basis.

This study's approach consisted of two major steps. The first step aimed to provide the theoretical basis by comparing the theory of NPG with an existing blockchain-based public service in greater detail. To better reflect the transformation sparked by the use of blockchain, this comparison also examined the public service before the implementation of blockchain. At the end of the first step, the comparison indicated how the use of blockchain has transformed this in-scope public service in the direction of NPG as well as revealed potential gaps. In the second step, expert opinions were leveraged in a Delphi study to challenge and extend the major findings from the first step.

With regard to the first step, to compare NPG theory with an existing public service, an adequate classification system was required. Torfing et al. (2020) offered a suitable approach with their so-called "public governance diamond" and its five dimensions (see Table 5).

Table 5: Dimensions of the Public Governance Diamond

Source: Torfing et al. (2020, 18f)

Dimension	Brief description
Centralized control	The degree of centralized control in the vertical chain of command.
Horizontal coordination	The degree of horizontal interagency coordination and collaboration.
Societal involvement	The degree to which private for-profit or nonprofit actors, including citizens, should be involved in public governance.
Use of value articulation	The degree to which public governance should be based on the articulation of public values.
Use of incentives	The degree to which public governance should be based on conditional positive and negative incentives.

The public governance diamond is particularly useful because it is not tailored to a particular public governance paradigm. This is a critical feature since it seems likely that public services, regardless of their concrete technical implementation, could follow other, non-NPG-like traits. NPG theory and the two cases, namely the blockchain-based public service and the conventional public service, were rated against the five dimensions of the public governance diamond.

The public service leveraged for this research was the project on land title transfer at the Swedish Mapping, Cadastral and Land Registration Authority. The project aimed to design and implement "a secure process for real estate transactions and mortgage deeds" (Kairos Future, 2017, p. 4). This process covers a wide range of steps. It starts with the property owner who wants to sell a property, includes the activities of banks, agents and the Swedish authority, and ends with automated payments after the successful property transfer. Furthermore, it leveraged a private blockchain (Pignatelli et al., 2019) and was designed to be operated and used by public and nonpublic actors (Kairos Future, 2017).

This project was selected as a result of an evaluation of existing blockchain projects within the public sector (Brinkmann, 2021a). It seemed suitable as it matched several criteria: First, the nature of the in-scope public service typically involves many actors and thus offers opportunities for collaborative activities; second, the project presents a rather mature status, allowing for findings to be derived from practical experience; and finally, the project work is thoroughly documented, including the affected public service *with and without* (i.e., conventional) the use of blockchain. In summary, the two cases can be described as follows:

- The conventional case: This case described the Swedish public service of "transfer of land titles" *before* the implementation of blockchain. It considered public and nonpublic activities. Nonpublic activities may be conducted by, for example, sellers, buyers, or banks involved in the entire process, beginning with the property owner who wants to sell the property and the performance of the transaction at the end (Kairos Future, 2017).
- The blockchain-based case: This case focused on the same Swedish public service after the implementation of blockchain. Similar to the conventional case, it considered the steps and activities of public and nonpublic actors. Additionally, changes to the process flow and actor involvement were of particular interest.

To gather information on each of the two cases and NPG theory, an extensive literature review was conducted and mapped against the five dimensions of the public governance diamond. For this purpose, search engines and scientific data bases, including Springer Link, ACM Digital Library and ScienceDirect, were used. The literature review was followed by a qualitative evaluation to derive a rating on a 7-point scale per dimension (Torfing et al., 2020), thus allowing this study to build a diamond-shaped graphical representation of the rating results per case.

In the second major step, the Delphi method was employed to verify and extend the major results of the previous step. The Delphi method is a "widely accepted and frequently used research method [that] follows an anonymous, multistage communication process" (Gnatzy, Warth, Gracht, & Darkow, 2011, p. 1681). A group of experts can bring in individual knowledge to generate and evaluate each other's ideas, often in a setup of multiple rounds (Kloser, 2014). The Delphi method is frequently attributed with the aim of generating a consensus among a group of experts (e.g., Jeste et al. (2010), Kloser (2014)). However, Cuhls (2019) pointed to the value of identifying either areas of agreement or contested areas and perceived an absence of consensus in the Delphi method as an equally important finding.

The use of web technologies has led to a rather novel approach to the Delphi method in the hope of greater efficiency and interactivity among the experts (Sunderji & Waddell, 2015) through working in "real-time." Instead of conducting two or more rounds, iterative, real-time Delphi follows a "roundless" approach by instantly calculating the input and providing feedback to the experts (Cuhls, 2019; Helms, Gardner, & McInnes, 2017). It thus allows the experts to reflect on their input immediately. The present study selected the Foresight Strategy Cockpit by 4strat (2021) after comparing it with other Delphi-specialized tools.

Adding expert opinions from various fields to this research design through a real-time Delphi method was valuable for various reasons. First, both NPG and blockchain advocate a wider stakeholder approach. A similarly designed Delphi method, which considers those experts dealing with this environment, could show either agreement or disagreement with the key results from the previous step and point to additional considerations. Second, the composition of experts according to their profession could show whether, for example, experts of one profession have an understanding that differs from that of experts from another profession.

The use of blockchain technologies in the public sector can involve various stakeholder groups (Brinkmann, 2021b). This study deemed the most relevant stakeholders to be public servants and IT solution providers, including consultants and blockchain solution developers. Furthermore, this study considered researchers because they would add value by providing a scientific view on the otherwise rather practical views of the aforementioned stakeholders (Cuhls, 2019). The concrete experts were identified by conducting broad online research, including the evaluation of topic-related publications, universities and scientific organizations, and blockchain-related associations. Additionally, the present authors' social networks were included – this resulted in 7 participants from public administrations and IT solution providers. In total, 42 experts were identified among three professions: public servants (11 experts), researchers (11 experts), and IT solution providers (19 experts). Furthermore, this study chose experts who spoke the same language (German) to avoid any language difficulties, thereby potentially increasing the quality of the exchange during the Delphi method's implementation.

The questionnaire for the Delphi method was developed based on the major findings of the first major step, namely the comparison of NPG theory with the Swedish use case. The authors decided not to explicitly mention the Swedish use case within the questionnaire because it would have meant including various information, such as the public service before and after the blockchain project, stakeholder and governance matters, and concrete technical details. The authors assumed that doing so would increase the participants' preparation time for the survey, which could impair their motivation. Once drafted, the questionnaire comprised eight questions and was entered into the online tool; subsequently, it was pretested on individuals from the public and nonpublic sectors who possessed experience with this topic, and then adjusted according to their feedback; for example, definitions of terms were added and the wording was changed (see Supplemental Materials for the questionnaire). Shortly after, the identified 44 experts first received a written invitation requesting their participation. A total of 23 experts agreed and received an individual link to participate. This began the survey period, which lasted for two weeks. This period seemed appropriate as a previous real-time survey indicated that experts would not participate more than twice (Cuhls, 2019). During this time, the experts received reminders motivating them to either participate or to review the other experts' answers again. In total, 19 experts had participated by the end of the survey period, comprising six public servants, five researchers, and eight IT solution provider. When the survey period, the answers were both evaluated quantitatively and qualitatively by the authors and then used to re-evaluate the findings from the first step.

3.6 Results

In the first major step, the two cases were compared with NPG theory by leveraging the public governance diamond and its five dimensions. Table 6 summarizes the results of the literature review that was conducted to rate the individual cases per dimension. Details of the reasoning are provided in the supplemental materials accompanying this article.

Table 6: Summarized Results of the Theory and Case Comparison

Public governance diamond dimension	Rating / Essential reasoning		
	Idealized NPG theory	"Land title transfer" – Conventional case	"Land title transfer" – Blockchain-based case
Centralized control	1 / Emphasizes the shift toward self-governing networks (Torfing et al., 2020). It also focuses on jointly designing and delivering public services (Christensen & Lægreid, 2014; Osborne & Radnor, 2016).	4 / Multiple actors are in control of their individual part of the value chain; hence, no centralized control of the value chain; major governance decisions regarding public service (e.g., legal requirements) by public administration.	3 / Blockchain setup increased the independence of process actors along the process; however, actors are bound to the obligatory system predefined by a few (Pignatelli et al., 2019; SAP, 2021).
Horizontal coordination	7 / Strongly recommends horizontal coordination in cross boundary networks (Osborne, 2010; Torfing et al., 2020) and collaboration	1 / Rather disintegrated process steps result in multiple actor-specific processes (Kairos Future, 2017); public administrations, in	7 / Blockchain integrates previous isolated process steps; interorganizational networking realized; public service process secured;

Public governance diamond dimension	Rating / Essential reasoning		
	Idealized NPG theory	"Land title transfer" – Conventional case	"Land title transfer" – Blockchain-based case
	among actors for joint problem solving (Loeffler & Bovaird, 2018).	particular, only engaged in a few steps within real-estate transactions;	nonpublic actors can take over new tasks such as sellers' checking their ownership situation by themselves (Kairos Future, 2017).
Societal involvement	7 / Prefers inclusion of a wide range of social actors. (Ansell, 2014; Pestoff, 2012).	2 / Already participating in collaboration projects; however, overall process considered by individual actors and within their boundaries (Lantmateriet, 2021a, 2021b).	6 / New responsibilities implemented for nonpublic actors; increased number of actors with respect to technical governance; public administration not willing to share every aspect of governance (Brinkmann, 2021a).

	Rating / Essential reasoning		
Public governance diamond dimension	Idealized NPG theory	"Land title transfer" – Conventional case	"Land title transfer" – Blockchain-based case
Use of value articulation	4 / Acknowledges role of public values in governance and networks; however, value articulation is less central (Torfing et al., 2020). Can be difficult to align different value sets (Ansell, 2016; Xu et al., 2015).	2 / Occasional interorganizational appeals can be assumed as part of ongoing collaboration projects (Lantmateriet, 2021b).	3 / Actors are driven by values of efficiency, effectiveness, and transparency (Kairos Future, 2017; Pignatelli et al., 2019).
Use of incentives	4 / Incentives can render participation in networks and incentives generally seen as playing marginal role in governance processes (Torfing et al., 2020); relations supposed to present win-win situations	3 / Obligations for nonpublic actors by law; official confirmation of ownership by public administration (Kairos Future, 2017).	4 / Multiple positive incentives (Kairos Future, 2017; Pignatelli et al., 2019) also because of jointly delivered public services, such as "faster and more transparent transactions" (Kairos Future, 2017);

Public governance diamond dimension	Rating / Essential reasoning		
	Idealized NPG theory	"Land title transfer" – Conventional case	"Land title transfer" – Blockchain-based case
	(Brandsen & Johnston, 2018; Loeffler & Bovaird, 2018).		collaboration may be seen as driver for motivation / commitment.

Subsequently, the results of the comparison were put into context with the results of the Delphi survey. The combination of the case comparison and Delphi method delivered a comprehensive picture of the differences and similarities within each dimension (see Figure 3). To support this comprehensive picture per dimension, the results of the comparison and leveraged Delphi method are provided together in the following paragraphs.

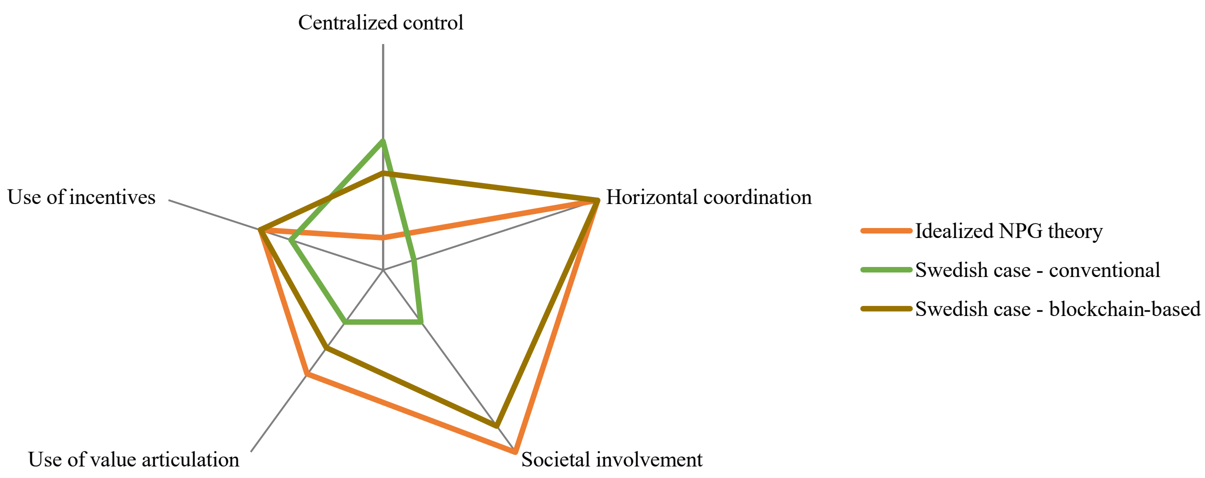

Figure 3: Public governance diamond: Comparison of NPG theory and the two Swedish cases.

Regarding the dimension of *centralized control*, the results revealed differences between NPG theory and the two cases. The strong emphasis on self-governing networks within NPG theory contrasted with the cases' centralized characteristics, as manifested through rather centralized decision making by only a few stakeholders. Two aspects hindered lower degrees of such centralized control, namely the perception of public administration as playing a coordinating role and the use of a consortium for blockchain governance. Both aspects place one or only a few key stakeholders in a strong position. Most of the experts particularly agreed with the necessity of public administration as coordinator due it being perceived as a trusted entity, with trust playing a major role for crucial public services. As one expert pointed out: "I have doubts whether a blockchain-based administrative service would be adopted and accepted without [a public administration as a 'trust provider']". Furthermore, the experts partially agreed that choosing a consortium governance model could impact the trust of a public service user because consortium partners may not be perceived as sufficiently trustworthy. However, some experts raised the question of whether users of a blockchain-based public service should know about the technical conditions and should rather only focus on the service.

As previously mentioned, NPG theory promotes a stark shift toward *horizontal coordination*, which led to very high rating. In the same manner, the blockchain-based case revealed a high degree of process integration across stakeholders as well as efficient collaboration. This in line with the beliefs of most experts generally, as they thought that blockchain technology would allow a complete integration of the public service across all involved actors. At the same time, many experts admitted that although blockchain could connect actors, human interaction (e.g., for application validation checks) and interfaces for company-internal structures (i.e., their processes, systems, and data) would remain outside of the blockchain. Consequently, additional, non-blockchain-related governance mechanisms seem necessary to deal with such off-chain content. One expert argued: "if companies are also involved in an public service, internal processes and their interfaces to the public service will certainly remain in the company – and not in the blockchain". The interaction of multiple actors (e.g., connected through technical interfaces) also raises the question of how to ensure high-quality process inputs in support of high-quality process outputs. In contrast to the blockchain-based case, the conventional case was unable to demonstrate joint service delivery, instead indicating a rather disintegrated way of working. Therefore, the conventional case scored very low.

In reference to *societal involvement*, NPG theory as well as the blockchain-based case both scored considerably highly. This was not surprising as NPG theory favors horizontal coordination; furthermore, it envisages the inclusion of a wide range of societal actors who are affected by the respective public service. Similarly, with the use of blockchain, the Swedish public service could increase the number of actors involved in the process as well as technical governance. Nonpublic actors could take over new tasks and responsibilities. Nonetheless, the Swedish public administration found it important not to share every aspect of governance. Noteworthily, according to most of the experts, the aspect of societal involvement appeared to also be highly relevant in terms of blockchain governance. These experts' assumed decisions on blockchain governance may also have an impact on user acceptance and user trust in the level of public service, which would support the high assessment of this dimension. For example, one expert stated that "without appropriate governance, there will hardly be any acceptance".

By contrast, the score for the *use of value articulation* dimension was comparatively low. NPG theory recognizes the use of public values in networks and governance (Torfing et al., 2020), but it finds it challenging to align diverging value sets (Ansell, 2016; Bovaird & Löffler, 2012). Additionally, both cases received low scores. The documentation evaluation related to the blockchain-based public service (Kairos Future, 2017; Pignatelli et al., 2019) suggested that values are not perceived as the primary driver, although an alignment of goals and purposes seemed necessary for key actors to jointly (further) develop the blockchain-based public service. Regarding the conventional case, it seemed plausible to assume at least an occasional articulation and alignment of values and purposes because the Swedish public administration already participates in various forms of exchange with nonpublic actors on collaborative projects. These preliminary comparison results seemed too low, however, because three-quarters of the experts argued that a joint formulation of values is required for the design of a blockchain-based public service. A joint commitment to the confirmation of common values could shape the system design as well as act as a "north star" under which the blockchain-based public service was implemented for later public service users.

Finally, the *use of incentives* appeared relevant for both of the cases and NPG theory. NPG theory recognizes the minor role of incentives but is still useful for encouraging actors to participate in networks and engage in collective problem solving. The blockchain-based case also leveraged incentives, especially with respect to benefits that result from the use of blockchain-based public service, such as improved process efficiencies. Furthermore, the improved collaborative partnership or the unique, innovative technological setup may spur actor engagement. Nonetheless, the experts argued that incentives should work at the public service level as well as focus and communicate service benefits, such as improved process efficiencies. Blockchain would remain a technology in the background and should not be of interest to public service users. This understanding applies to the use of positive as well as negative incentives. An example of the latter might be the establishment of hurdles to the use of the conventional public service, as was indicated by some experts. In the conventional case, the public service predominantly harnesses legal obligations to ensure actor engagement, such as stamp duty or the required service charges, thus relying on negative incentives. However, the public administration is also employing a positive legal incentive by offering an official confirmation of real-estate ownership.

3.7 Discussion

The combination of the case comparison and Delphi method made two significant observations possible. First, the conventional case mostly scored the lowest compared with the other case and NPG theory. However, it scored the highest with respect to centralized control. The conventional setup establishes a strong role for the public administration, which was unsurprising because public governance paradigms, New Public Management, and traditional public administration in particular are predominant in Europe (Pestoff, 2011). They promote a stronger position for public administrations among the various actors.

Second, the results indicated that the Swedish use case came much closer to NPG theory in many dimensions due to the use of blockchain. Again, it was centralized control that remained relatively unchanged. The Swedish authority has opened to others by leveraging blockchain technology; yet, at the same time, the number of actors allowed to participate in key governance decisions is limited to just a few select actors who make the rules. It is noteworthy that this participation occurs at the level of blockchain governance in particular, which directly impacts the level of public service. The lines between the two levels seem to blur. In contrast to the centralized coordination, the implementation of blockchain has apparently led to significant shifts with respect to societal involvement and horizontal coordination, and also toward NPG theory. The idea and "technical nature" of blockchain support the inclusion of many actors and allow high process integration, which are key to NPG theory.

3.8 Conclusions

The main aim of this study was to holistically determine the value of a blockchain-based public service system shaped by the characteristics of NPG. As was clearly demonstrated, a blockchain-based public service can apparently make a large difference in public service delivery and represents a great shift toward NPG.

Because this study relied not only on theoretical but also empirical work, it faced limitations that should be considered when interpreting its results. First, this study considered the public service of the Swedish Mapping, Cadastral and Land Registration Authority. Therefore, the analysis considered the information and circumstances of this public service and project. Some of the experts, who were all unaware of the analyzed Swedish use-case and instead answered generalized questions (see Section 4), argued that the results may vary depending on the public service under investigation. Hence, it would be valuable for future studies to investigate whether different public services or even blockchain characteristics could lead to different outcomes if, for example, they consider more or less critical/sovereign data. A potential research question is as follows: What would public governance look like under different functional or technical circumstances?

In addition, the Delphi method could also represent a source of failure. Although the questionnaire was properly pretested on other experts, the risk exists that they misinterpreted the questions or the meanings of certain vocabulary. This may have misled the authors when evaluating the answers.

This article also provides multiple starting points for further research, such as the aforementioned verification of the results using other blockchain characteristics or public services. Another starting point could be derived from the response behavior of the experts. While the researchers and public servants expressed diverging views, the IT solution providers often leaned strongly toward a positive or highly relevant perception on certain matters. It may be worthwhile to further investigate these different streams as they may point to the alignment needs of involved actors as well as their motives (e.g., economic and marketing-related motives). Furthermore, because the coordinating role of public administrations seemed relevant to NPG theory and the experts, further attention should be paid to elaborating the potential tasks and responsibilities of such a role. The experts referred to various possible designs with, for example, either legal or technology-related obligations. Moreover, because some of the experts pointed to the influence of consortia partners on the trust of public service users and IT security, the selection criteria required to identify adequate consortia partners should be investigated. This is because blockchain consortia are likely to be chosen again for other blockchain projects in the future.

Finally, public administration managers could employ this study's results in their efforts to evaluate new ways of providing a more collaborative public service delivery. The results could also provide a practical – rather strategic – orientation for discussions with colleagues and service providers regarding the purpose of blockchain for their domain.

3.9 Contribution to overarching dissertation

This article contributes in many ways to the overall objective of this dissertation. Major contributions were achieved by extending the conceptual knowledge on the use of blockchain for public governance purposes, i.e., New Public Governance. The use of an adequate framework of analysis, the public governance diamond, enabled a differentiated comparison between the theorical paradigm of New Public Governance and the changes by the use of blockchain. Hence, the understanding of blockchain's impact on public governance and administration could be strengthened.

This extension of knowledge not only rests upon a theoretical base but also empirical evidence by, first, basing the analysis on a real-life blockchain implementation and the changes it brought to the public administration and other stakeholders. And second, the participation of subject matter experts in a Delphi study allowed to validate initial findings by integrating relevant experience of public servants, IT service providers and researchers. Consequently, the article supported to establish a link between the theorical and empirical shares of this topic.

4. Empirical Observations on Blockchain's Impact Toward New Public Governance

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4.1 Abstract

Blockchain technology and New Public Governance represent promising concepts for various researchers. As such, both concepts offer the vision of an altered relationship between public administration and its non-public actors by emphasizing a strong position of non-public actors for public service delivery. This research aims to identify the relevance of New Public Governance to leading blockchain implementations in the European public sector. For this purpose, both topics are combined in an explorative analysis. The analysis leverages an adapted analysis framework designed for this research effort to structure the expectations around New Public Governance. Qualitative interviews with multiple key stakeholders of blockchain implementations projects were conducted to understand the actual impact of blockchain on the actor's relationships for public service delivery. This article presents the findings to this question and concludes that the use of blockchain has the changed actor relationships only in parts. Consequently, the author finally draws attention to the importance of blockchain governance and blockchain regulation for further developing the relationships of public administrations and their non-public counterparts.

4.2 Introduction

The development and transformation of public administrations has been an ongoing topic among researchers for decades (Bannister & Connolly, 2014; Pestoff, 2012). These discussions continue as changing political, societal, and economic challenges demand constant reflection on the way public administrations are set up. In terms of dealing with these challenges, the reform paradigm of New Public Governance (NPG) is widely perceived as delivering new perspectives on the fundamental development of public administrations. It demonstrates a shift towards collaborative forms of interaction between various actors and, therefore, places a great deal of focus on governance (Osborne, 2010; Xu et al., 2015).

Information technology is already supporting transformative efforts within the public sector (Nielsen, 2016), e.g. to enable participative governance (A. Meijer, 2012; Rodríguez Bolívar, 2018) or drive the exchange between public and non-public actors (Mergel et al., 2018). Distributed ledger technologies, the new technology of blockchain in particular, are said to facilitate this exchange by questioning the fundamentals of public administration (Reijers et al., 2016). It raises both hopes and questions among scholars and practitioners alike, leading to a number of activities designed to improve the understanding of its impact on the public sector.

However, structured and more detailed scientific efforts to assess the institutional implications of the use of blockchain are scarce (Brinkmann & Heine, 2019; Ølnes et al., 2017). This applies to the theoretical question of NPG, in particular, and to what extent it could benefit from blockchain. As with any other research, it is important to expand and check theoretical work through complementary empirical research. To date, many blockchain projects have been conducted worldwide with the aim of changing the way that public services are delivered. Those projects seek to change a wide range of public services, e.g. with respect to land title registry, digital identities or academic credentials (The Illinois Blockchain Initiative, 2018). From a scientific standpoint, it is beneficial to evaluate these projects empirically to see whether they are in line with the theoretical discussions on the development of public administrations. These insights could provide valuable feedback for further research agendas and may also shape the design of blockchain projects to come.

Consequently, this article focuses on closing this empirical gap. The aim of this research is to conduct a small-N case study to assess whether the functional expectations associated with NPG match with what is actually delivered today. NPG, for example, is expected to provide public services in a co-producing and bilateral manner between various actors. When the outcome of a blockchain project enables this kind of service delivery, it is likely able to support the fulfillment these expectations around NPG.

This article describes these research efforts and results, and is structured as follows. Within the second section, the foundations of NPG and blockchain are described and, thereby, the core elements of NPG are introduced, setting out the basic parameters for the expectations it gives rise to. The next section explains the methodological approach in greater detail. This includes the definition of an expectation analysis framework as well as explanations regarding case study selection and questionnaire design. The fourth section combines the outcome from conducted interviews and a corresponding discussion to effectively highlight matching and mismatching expectations. Finally, the conclusion section summarizes the major findings with respect to this article's research aim and presents the limitations of this research approach as well as recommendations for further research.

4.3 Background

As outlined, this article seeks empirical evidence that combining NPG and blockchain technology can add value. Hence, this section explains the foundations of both subjects and also introduces the characteristics they possess that are essential for this article.

4.3.1 New Public Governance

Public administrations serve a wide range of purposes. They are supporters, regulating and supervising bodies, counselors, etc. (Wimmer, 2010) for various stakeholders. It is worth noting that actions essentially can affect a varying number of actors ranging from one individual actor to the society as a whole. Latter is crucial in the context of social affairs (Rychkova & Zdravkovic, 2017) as many public administrations seek a balanced social system by continuously shifting resources between actors. Making decisions on these various matters requires them to be capable of dealing with varying circumstances (Atzori, 2015; Dale et al., 2013). Being able to do so implies the ability to manage knowledge, including its availability or accurateness on alternating levels (Dale et al., 2013).

Admittedly, this perception is a rather idealistic one; the status quo of public administrations is often characterized as inflexible or inefficient (Bakken & Hernes, 2003), as well as insufficiently transparent (Zuiderwijk, Shinde, & Janssen, 2019) or increasingly complex (O'Connor, Janenova, & Knox, 2019). This makes it difficult to overcome challenges such as the individualization of society, globally diffused business models (Schedler & Proeller, 2011), or increasingly complex interactions between public administrations.

Public reforms aimed at transforming public administrations have been started in various countries. However, reforms in Europe, which represent the scope of this article, mostly relate to the reform approach New Public Management and, thus, adhere to a narrowed, intraorganizational perspective (Osborne, 2010; Vries, 2010). This approach focuses on improving efficiency, budget, or quality within the administration (Holtkamp, 2012). Intraorganizational reforms alone are unlikely to diffuse the dissatisfaction of citizens. This raises the question of how public services should instead be delivered. It would be beneficial to add an interorganizational perspective to the intraorganizational perspective of New Public Management (Vries, 2010). However, this requirement is rarely fulfilled in practice (Torfing & Triantafillou, 2016b).

Not surprisingly, researchers are challenging the principles of public administrations (van de Walle & Groeneveld, 2017; Wiesel & Modell, 2014), and their interest in bilateral and informal procedures of cooperation, in particular, is constantly increasing

(Rodríguez Bolívar, 2018; Schedler & Proeller, 2011). Networks of self-organizing and participating stakeholders are also in the scope of today's research (Atzori, 2015; Wimmer, 2010). Consequently, public services provided to and by different stakeholders would require a very different understanding of the management of this kind of service delivery system, establishing a new focus on governance.

Formal as well as informal processes are required to allow collaborative interaction between stakeholders and, thereby, enable this governance-focused paradigm (Torfing & Triantafillou, 2016b). Such focus on governance is perceived as a further development of public governance, and is known as New Public Governance (NPG). NPG aims to improve the efficiency and quality of public services. One important principle of this is collaborative governance, which considers the combination of the capacities of businesses, society, public administrations, and the third sector. Actors work together when they are interested in either joint results or joint service delivery (Ansell, 2016). Trust and integrated leadership are also essential principles for this governance paradigm (Torfing & Triantafillou, 2016b).

Pestoff (Pestoff, 2012) noted that the understanding and composition of actors also changes with the introduction of NPG. With NPG, the traditional, rather economic view, including buyers, contractors, customers, etc., must be related to civil leadership, partnerships, and networks. The central role that public administrations have today would change in a public service delivery system that relies on collaborative governance between multiple actors. Public administrations would become one out of many (Kennett, 2010; Osborne, 2010; Rychkova & Zdravkovic, 2017). The collaborative delivery of public services by public and non-public actors is consensus-oriented and, therefore, requires adequate incentives for actors to ensure active participation in service delivery (Torfing & Triantafillou, 2016b). Consequently, mandatory collaboration for public service delivery would weaken the original idea of New Public Governance, which favors consensus among involved actors.

In summary, three core elements of NPG can be identified, as outlined in Table 7. The effectiveness of an NPG-based public service delivery system depends on the degree of coverage of these three core elements. The implementation of these core elements in a public administration would most likely require large-scale reorganization.

Table 7: Description of NPG core elements

Source: own elaboration.

NPG core element (Brinkmann & Heine, 2019)	Description
Voluntary Co-Producing Networks	Public services are delivered in a networking manner by public and non-public actors. The delivery is consensus-oriented and can take place without the involvement of public administrations. It combines actor capacities collaboratively to jointly deliver public services (Osborne, 2010; Rychkova & Zdravkovic, 2017).
Inter-Organizational Governance	Proper coordination takes place across actors to deliver public services. This includes the alignment of design, execution, and monitoring/evaluation of service delivery (Osborne & Radnor, 2016).
Contracts and Trust-Based Management	Formal and informal procedures are leveraged to coordinate and jointly deliver public services (Torfing & Triantafillou, 2016b).

In the past, Information and Communication Technology (ICT) has played an important role in facilitating the reorganization of public administrations. ICT could again emerge as a critical success factor for collaboration between public administrations and their stakeholders in terms of NPG. In fact, ICT is already enabling participation by citizens and businesses alike (Pestoff, 2012; Warf, 2014), for example by opening up data silos to non-public stakeholders. This can be seen as a manifestation of open government, which aims to redefine the interaction between public administrations and their stakeholders (Hilgers & Ihl, 2010) in order to ultimately strengthen democratic societies (Lathrop & Ruma, 2010). Some scholars argue, however, that digitalizing the exchange between public and non-public actors has not always fulfilled these promises (Mahizhnan, 2014).

4.3.2 Blockchain

Blockchain is widely perceived as a recent promise to reestablish the relationship between public and non-public actors. With blockchain, actors can reliably exchange various digital assets such as currency, contracts, or access rights. It evolved as one of the distributed ledger technologies, which forms a network of nodes that hosts securely stored data (Yli-Huumo et al., 2016). Software programs, so-called protocols, then conduct transactions in this ledger to fulfill a purpose within a field of application (Swan, 2015). Whether one can join, read, or write on a blockchain network is dependent on the setup of the blockchain environment. Public blockchains are open to everybody, and no dedicated authorization for users is required. However, users of private blockchain networks need to be granted access by a defined authority (Beck et al., 2018). The strength and promise of blockchain result from its key functional characteristics. There is a wide range of characteristics associated with blockchain (Seebacher & Schüritz, 2017; Yli-Huumo et al., 2016; Zheng et al., 2018), but on a functional level it comes down to four essential characteristics (Zheng et al., 2018).

The immutability of data, as one key characteristic, ensures that data (e.g. voting results) cannot be changed once they are stored in the blockchain. This is enabled by the combined use of cryptography and the way each block is linked to another block. However, this feature also presents a challenge for data privacy, especially in Europe. The European General Data Protection Regulation (GDPR) gives citizens the right to have their data be forgotten (Rosen, 2011), which is in opposition to blockchain's unalterable nature. Scholars and practitioners alike are still in the process of finding answers and solutions to this issue.

The second key characteristic concerns the decentralized setup of the blockchain network. Citizens, businesses, or public administrations can exchange their data on a peer-to-peer basis (Seebacher & Schüritz, 2017), i.e. without an intermediate entity. Thereby, bilateral working modes are the norm. The exchange of data between two users takes place based on predefined procedures.

In addition, the blockchain network is consensus-driven. This third characteristic refers to the fact that users have the same understanding of what the shared data is and, thus, they agree on its accurateness. It is worth noting that this does not necessarily mean that the data itself is accurate, when false data is being delivered, e.g. by legacy systems. That is why the transition of data from an off-chain to an on-chain environment is critical for the overall acceptance of a blockchain network.

Transparency of data, the fourth key characteristic, is another appealing feature for users. They are able to access the history of all the transactions that have ever occurred. This could contribute to public services being trusted and accepted because, for example, decisions made, or rules applied in the making of decisions, could become traceable for all (Nofer, Gomber, Hinz, & Schiereck, 2017). In particular, smart contracts build on blockchain's transparency and decentralization. This effective tool supports the automated execution of transactions when certain upfront-coded criteria are met (Ølnes et al., 2017). They can be executed as a result of or as a replacement for manual bilateral interaction. Additionally, the code behind smart contracts and, thus, the underlying rules are transparent to everyone.

Scholars and public and non-public stakeholders around the world are trying to identify what potential this comparatively new blockchain technology may have for their organizations (Ølnes et al., 2017). A large number of projects have been started, partly with the involvement of both public and non-public stakeholders within individual projects. In addition, national or local governments in various countries, such as the US or within the EU area, are increasing their efforts to regulate and legislate for blockchain. These governments are focusing their attention on cryptocurrencies (including Initial Coin Offerings), crypto tokens, and smart contracts (Blemus, 2018).

Also, many scholars continue to focus on cryptocurrencies (Atzori, 2015). The fields of application, however, reach way beyond financials (Nofer et al., 2017). Atzori (Atzori, 2015) and Ølnes et al. (Ølnes et al., 2017) acknowledge, among other points, a lack of attention being paid to issues of governance. Generally speaking, governance concerns the process of decision making, including the definition of the decisions to be made and the accountability for them (Klischewski, 2018; Rychkova & Zdravkovic, 2017). This is critical within the domain of public administration and NPG, particularly when blockchain enthusiasts argue in favor of a self-organizing society that functions via blockchain (Atzori, 2015). Approaches to blockchain governance are still in the very early stages (Brinkmann & Heine, 2019; Campbell-Verduyn, 2018a) and should be developed further (Beck et al., 2018).

However, this article argues that governance takes place on organizational and technological levels and should be considered holistically. On an organizational level, blockchain can support processes of governance (“governance by blockchain”), whereas the operation of blockchain technology itself requires adequate governance on the technological side ("governance of blockchain") (Brinkmann & Heine, 2019; Ølnes et al., 2017).

Being an institutional technology of governance (Campbell-Verduyn, 2018a; Davidson et al., 2016a), blockchain could pave the way for a redesign of organizational processes, roles, and responsibilities since it could significantly reduce the number of intermediaries (Klischewski, 2018). The support of bilateral modes of working requires a new self-conception of the public administration contribution to direct and customized interaction between stakeholders. Public and non-public stakeholders could benefit from this institutional technology as trust could be restored, coordination efforts improved, and costs of administration lowered (Davidson et al., 2016a). Nonetheless, governance cannot be entirely covered by blockchain, e.g. with respect to dispute resolution or negotiations (Beck et al., 2018; Brinkmann & Heine, 2019). The alignment of multiple governance procedures may consequently become essential. Brinkmann and Heine (Brinkmann & Heine, 2019) demonstrate these functional overlaps and gaps with their conceptual work on matching up the technology of blockchain and the paradigm of NPG. The comparison of these two concepts proves that, theoretically, the functional match increases on an operational level and decreases on the strategic level of a public service delivery system.

Governance-related decisions regarding technology such as blockchain can directly impact the organizational layout (Ølnes et al., 2017). Understanding the relationships of the architectural elements of data, application, and infrastructure to the organization is crucial to successfully creating an effective concept of institutional governance. And it seems necessary to assume that multiple parties would be part of the decentralized development and operation of a blockchain network, not only to support the original vision of blockchain but also because competencies in this field are already scattered, reflecting the different levels of experience and interests of those parties. Thus, governance of blockchain implies proper management along the whole technology lifecycle, e.g. ownership or responsibilities for development (Atzori, 2015; Ølnes et al., 2017). If the ICT infrastructure of a decentralized public service delivery system were owned by only a few actors, they would have both great responsibility and the power to intentionally or unintentionally impact non-technical matters. Therefore, creating an accepted governance model for all involved parties is mandatory.

4.4 Methodology

This section presents the research design and, thus, introduces the method leveraged to empirically assess whether the functional expectations for NPG match with the outcomes of the reviewed projects. Two important factors can be derived from this question which significantly influence the research design. First, asking whether NPG played a role in the design of blockchain implementations; this indicates an X-centered focus, i.e. the attempt to better understand the influence of an independent variable on a dependent variable (Blatter & Haverland, 2014; Blatter, Langer, & Wagemann, 2018). And second, this question seeks to understand the project results as they represent the manifestation of design considerations of a blockchain implementation project.

Taking into account the explorative nature of this empirical research and the fact that blockchain technology is comparatively new, the author choses to conduct a qualitative small-N analysis (Blatter et al., 2018) to further explore this object of research (Merriam & Tisdell, 2016; Schnell, Hill, & Esser, 2018). Data shall be gathered from interviews with project representatives. The steps listed below were then followed to achieve the goal of this research.

The aim of the first step was to define an adequate analysis framework. The foundation of this analysis is the "logical framework method for defining project success" (Baccarini, 1999), which was adjusted to fit the purpose of this research. Although the author does not want to decide whether a blockchain project is successful, this framework nonetheless provides useful dimensions and corresponding questions on how to appraise project value. It is assumed that (implicitly) considering NPG cannot only be assessed by the degree of covered requirements and system functionalities. Instead, the achieved purpose of the system and the underlying goals of the project also provide important indicators as to the importance of NPG. It can be assumed that NPG is most important to a project when the project meets the dimension expectations associated with NPG. Table 8 illustrates this expectation analysis framework.

Table 8: Structure of expectation analysis framework and expectations for NPG coverage

Dimension (Baccarini, 1999)	NPG-related interpretation	Potential expectations for NPG coverage
Output	Does this BC solution cover the functional requirements related to NPG core elements?	▪ Enable co-producing network ▪ Consider user voluntariness ▪ Concept for interorganizational governance, including aspects of blockchain governance ▪ Contracting between actors ▪ Handle informal processes
Goal	Does this BC solution provide NPG-related qualitive and quantitative improvements to the in-scope public service?	▪ Efficiency gains, e.g. cost ▪ Increase customization of public services ▪ Decrease coordination effort between actors ▪ (Re-)Arrange roles and responsibilities

Dimension (Baccarini, 1999)	NPG-related interpretation	Potential expectations for NPG coverage
Purpose	Does this BC solution provide benefits to the public administration's assumed NPG-related mission?	▪ Strengthen relationship with citizens or businesses ▪ Increase trust in public administration ▪ Stronger leverage of non-public resources ▪ Increase quality of public service ▪ Increase perception of equality between public and non-public actors

It is worth noting that there is a fourth dimension, "Input", within Baccarini's (Baccarini, 1999) framework. This dimension is considered out of scope because it would involve factors such as the course of the project or stakeholder involvement during the project (Baccarini, 1999; Shenhar, Dvir, Levy, & Maltz, 2001), which would not add value to the result-oriented analysis of this article.

Step two of the methodology covered the identification of suitable public blockchain projects. To achieve this, broad internet research was conducted between August and October 2019 to find blockchain implementations by public administrations around the world. This included the use of search engines, the analysis of databases (such as the "Blockchain in Government Tracker" by The Illinois Blockchain Initiative (The Illinois Blockchain Initiative, 2018), public administrations' press releases, and public records (e.g. Pignatelli et al. (Pignatelli et al., 2019) and the European Union Blockchain Observatory and Forum (European Union Blockchain Observatory and Forum, 2020). The use of multiple sources supported the validation of project information (Yin, 2009) because it allowed for identifying inconsistencies or outdated data and closing information gaps. The projects found were then brought together and short-listed based on two major considerations for suitability:

- First, blockchain projects were perceived suitable when at least one governmental process implementation was in scope. In contrast, blockchain projects were treated as not suitable when they focused on theoretical, conceptual, or strategy work (technology standards, legislation, or country strategies) or the introduction of cryptocurrencies.
- Second, a blockchain project was further considered suitable when its status was at least advanced by the time of the aspired interview, e.g. having pilot status or a mature proof of concept. Thus, only those projects are to be examined more closely that have probably already been able to gain significant practical experience.

For the identification of suitable blockchain projects, 211 public blockchain projects all over the world were found and analyzed, and 32 were deemed suitable for the article's research objective (see project overview provided as supplemental material along with this article). Once suitable candidates had been identified, an interview request was sent via email to contacts identified via further internet research. If a contact did not respond to the initial email, reminders were sent to them. In the end, out of those 32, three project representatives replied and agreed to participate in this interview. 29 contacts did not reply at all, declined an interview or did not get back to the author for further information, although promised to do so. The project representatives were key stakeholders of their project and involved at a strategic level. The gathered information of the three selected projects were later validated during the interviews by considering relevant questions in the questionnaire to ensure an accurate project summary. An overview of the 211 analyzed blockchain projects is added as supplemental material to this article.

Table 9: Overview of in-scope blockchain implementation projects

Characteristic	Project 1	Project 2	Project 3
Project location	Malta, Europe	Zug, Switzerland, Europe	Sweden, Europe
Public administration in scope	Ministry for Education and Employment	City of Zug	Swedish Mapping, Cadastral and Land Registration Authority
Level of administration	National	Local	National
Relevant public service	Issue and authentication of education credentials	Proof of residency (eID)	Transfer of land titles
Use case description	Blockchain-based educational certificate issued by public admin. Citizen indicates hash code of certificate when needed Third party can check hash code if indicated certificate is valid	Citizens request blockchain-based identity (eID) Citizen and public admin. register eID Citizen can then use this eID as authentication for public and non-public services	Blockchain is used as a platform to securely store the process status of land title transfers Process workflow is executed off-chain on separate component
Blockchain configuration	Public permissionless	Public permissionless	Private permissioned
Source code	Open Source	Open Source	Proprietary
Project status	Pilot	Pilot	Proof of concept

Due to the low number of projects, the results cannot be considered representative. However, a small-N case study can provide valuable explorative findings (Blatter & Haverland, 2014). Table 9 introduces the three projects that participated in these interviews. The three projects show different characteristics and, thereby, offer a wider field to extract findings from. Especially, the proprietary and private nature of one solution may offer the chance to implement functions differently. Also, local public administrations are rather show a more intense citizen contact than administrations at a national level. However, all three projects have in common that they are not in production and are, at best, in pilot status. In fact, research has shown that this is what similar public sector blockchain implementations around the world mostly have in common. As a consequence, the projects cannot benefit from much in the way of specific previous experience. Because the three selected projects are located in Europe, this research offers the opportunity to gain deeper insights into the status quo and the challenges of the European blockchain project landscape.

The third step the methodology comprised the design of the questionnaire for an interview guide approach. Due to the explorative character of this research, a partially structured interview guide was designed (Schnell et al., 2018). Subject areas and corresponding open questions (Mayer, 2008) were derived from the expectations detailed for each of the analysis framework's dimensions and complemented by a literature review for further details. In the end, the interview guide consisted of 23 questions asking, for example, about the motivation for the project, its effects on the role of citizens, or aspects of blockchain governance. To ensure a high-quality questionnaire, the questionnaire was pretested within the team of researchers and improved accordingly.

In step four, the interviews were conducted. Interviewees were given the choice of either an in-person interview at their current location, wherever in the world that might be, or a face-to-face interview via video call (Table 10).

Table 10: Overview of in-scope blockchain implementation projects

Characteristic	Project 1	Project 2	Project 3
Project location	Malta, Europe	Zug, Switzerland, Europe	Sweden, Europe
Public administration in scope	Ministry for Education and Employment	City of Zug	Swedish Mapping, Cadastral and Land Registration Authority
Interviewee role	Project incubator to the ministry at executive level	Public project owner at executive level	Chief Innovation Officer of public administration
Number of interviews	1	1	1
Type of interview	Video call	Phone call	Video call
Language	English	German	English
Duration [a]	1:05 h	0:35 h	0:40 h

[a] Questionnaire is added as supplemental material to this article

All the interviews were recorded, with the agreement of the interviewees. Each interview was transcribed and answers were complemented with desk research to add additional information wherever possible.

In the fifth step, the interview outcomes were analyzed following a two-step approach. Basis for the analysis was a table consisting of the dimensions from the expectation framework (y-axis) and the NPG core elements (x-axis). First, the interviewees' statements and additional information from the desk research were then mapped against the designed table structure. The results of one project could also be compared to the other projects, allowing a cross-case analysis and the identification of regularities or differences, on the basis of which categories could be formed (advanced x-axis) (Kelle & Kluge, 2010; Merriam & Tisdell, 2016). With the definition of the categories, the initial mapping of statements and additional information was rearranged to meet the more detailed table structure. Once the rearrangement was completed, an interpretation in the light of expectations was conducted to understand whether a statement or finding either provides evidence to confirm or reject the expectation was met. By doing so, it is possible to show comprehensively whether an expectation was met and how strong each NPG core element was considered to be per dimension.

4.5 Results and discussion

This section provides the results of the conducted interviews and puts them into perspective. The multiple results are first summarized in Table 11, then presented in greater detail.

Table 11: Result summary per NPG core element

NPG core element	Result summary
Voluntary Co-Producing Networks	▪ Co-production hardly achieved ▪ Independence of non-public actors for public service execution increased ▪ Efficiency gains for public and non-public actors ▪ A lack of regulation may limit further use of blockchain ▪ Limited methods leveraged to incentivize actors

NPG core element	Result summary
Inter-Organizational Governance	▪ Traditional assignment of roles between public and non-public actors did not change significantly ▪ Governance capacities of public administration challenged due to blockchain governance complexities
Contracts and Trust-Based Management	▪ Contracting realized by combination of on- and off-chain components ▪ Smart contracts of no importance ▪ Informal processes continue to be handled off-chain

The results are structured in line with the core elements of NPG. Thereby, the findings can be viewed in the light of this article's research question of whether NPG, i.e. its core elements, is identifiable within the blockchain projects. The detailed interview analysis is added as supplemental material to this article.

4.5.1 Voluntary Co-Producing Networks

The projects show that blockchain is leveraged to replace traditional centralized methods of verification. These blockchain-supported public services do not constitute a fundamental change toward an NPG-oriented system of public service delivery. However, due to the use of blockchain, the actual service execution of the respective public services became more decentralized for all three projects, i.e. users of the blockchain solutions no longer rely on the public administrations (PA) as much as they used to in order to interact with other citizens, businesses, or PAs. For example, by leveraging the blockchain-based eID service, the citizens of Zug can directly engage with businesses and reliably prove their identity without actually contacting the responsible PA for every business transaction. This can be perceived as supporting the expectation that NPG facilitates co-production without PA involvement. Thereby, both public and non-public actors also achieve efficiency gains, e.g. by lowered administration costs (Pignatelli et al., 2019) or the fact that it is no longer necessary to travel in person to the PA's offices. Surely, PAs should carefully weigh up why they are undertaking the laborious journey toward blockchain-based public services. But a strong emphasis on efficiency gains raises the question of whether these could be better achieved by focusing efforts on alternative forms of digital transformation in the public sector, especially with respect to service and data interoperability and "Once Only" initiatives, as proposed by the European Commission (European Commission, 2014, 2020). Latter aim at more efficient data flows between and in PAs. In so doing, citizens should not have to disclose already known data more than once, leading to e.g. cost and time savings or improved service quality (European Commission, 2014).

The projects' service execution benefits from blockchain's decentralized approach and actively supports a shift of data ownership from PA to citizens, as can be clearly observed within the Maltese and Swiss projects. Thus, citizens in particular can better control the use of their data. This could potentially result in an increasing level of trust, as expected for NPG, since non-public actors become responsible for managing their own data. Also, the shift is a precondition for a direct exchange between actors of their own resources – in these cases data. As expected for NPG (Osborne, 2010), the resulting decreased dependence on PAs implies an increasing flexibility for non-public actors and reduced coordination effort on both sides. However, a larger shift of ownership cannot be conceived of by PAs at the moment because this would, in general, require key stakeholders within public administrations and governments to adopt a mindset open to the sharing of responsibility for public service delivery. Interestingly, all interviewees referred to the need for proper and aligned regulation, especially with respect to the European General Data Protection Regulation (GDPR). Existing regulation would leave too much room for interpretation and thereby carries the risk of unlawful behavior. Current regulation would also limit the potential ways in which public administrations could interact with non-public actors. Thus, it restricts the blockchain design options and hinders the expansion of blockchain networks.

However, apart from the service execution, the service design cannot be considered as a part of the joint decision making since the major functional specifications were defined by the three public administrations. This is because they either ensured the design activities remained internal or acknowledged that design decisions should remain the responsibility of PAs. Consequently, it seems rather questionable to conclude that the three projects truly strengthened collaborative working modes with the introduction of blockchain. In fact, the projects reveal cooperative work because the involved actors conduct their activities rather separately (Kozar, 2010).

In addition to co-production in NPG, the voluntary participation of non-public actors within co-production was also considered to a certain extent. Due to their public blockchain configuration, Malta and Zug were aware that citizen motivation was important for public acceptance of their solution. The approach to ensure participation, however, was focused on the use case and the usability of the technical solution (e.g. the users' mobile app) only. Furthermore, citizens will likely hesitate to use the blockchain-based solutions because the established process of the public services continue to exist and could be used instead. No other incentive could be identified which might further reduce the citizens' motivation to leverage a blockchain-based public service.

4.5.2 Inter-Organizational Governance

As stated in the Voluntary Co-Producing Networks section, the use of blockchain did not lead to an implementation of NPG in all areas of public service delivery, but rather focused on the public service delivery. This perception can also be supported with respect to governance. With NPG, the traditional role of public administration as decision maker would change in favor of joint decision making, and resources from various actors would be combined in order to deliver public services. The interviewees shared the belief that their traditional mode of working would not change dramatically with the implementation of blockchain. In fact, the public administrations made sure that deciding on changes to the public service or the blockchain solution remained within their remit. This was explained by the role of PAs as trusted entities, the need for strong leadership, and by the PAs' responsibility for the development and quality of public services.

With the use of blockchain, the development of and changes to public services are substantial, in terms of technology. Thus, the governance of a public service should also involve the governance of blockchain. But the governance of blockchain technology represents a substantial challenge, as outlined by the interviewees. Who should decide on changes to the technology? Who would be responsible for any wrongdoing? This summarizes the two major questions gathered during the interviews, and still requires an answer. This issue was one reason why the Swedish project chose to go for a private, proprietary blockchain solution as it can, thereby, better define the governance procedures for its blockchain solution. Consequently, open blockchain solutions, e.g. running on the Bitcoin or Ethereum networks, may be harder to control. Accordingly, the Zug project stipulated rules and responsibilities for the external provider. Nonetheless, contractual agreements cannot cover all eventualities when open blockchain solutions are used. The interviewee from the Zug project also referred to acceptance issues among non-public actors, e.g. due to the technical complexity of this externally developed solution or uncertain terms and conditions of the solution provider. Thus, the introduction of blockchain for the benefit of NPG could actually decrease governance capacities in order to prevent an unfavorable solution development for governments and increase complexity instead due to the multiple involved actors on technical level outside the public sector domain.

As a result, the Maltese and Swedish projects made a case for an overarching regulatory framework which could define the roles and responsibilities of public blockchain solutions and of blockchain solution providers in general. The European Blockchain Partnership was named as a good example of a facilitator on a European level. This demand for a joint regulatory framework seems appropriate in order to drive large-scale or interconnected blockchain solutions and, thereby, improve the impact of blockchain-based public services in terms of NPG. In fact, standardized blockchain solutions which could also speed up the spread of blockchain may only be accepted once proper regulation is in place. Last but not least, that joint regulatory framework would provide a promising opportunity to support blockchain users and solution providers to cope with the existing privacy and GDPR concerns.

4.5.3 Contracting and Trust-Based Management

Contracting represents formal types of interaction within NPG, whereas trust-based procedures rely on informal methods. For contracting purposes, blockchain offers the use of smart contracts to enforce the execution of upfront-coded transactions, which could include legal contracts, for example. The interviews showed that contracting in general only plays a significant role in the Swedish project, due to its importance for the buying and selling of land titles. But smart contracts, in particular, are not important at all for any of the projects. The Swedish project developed a contract engine that handles all land title-related contracts off-chain, with only the confirmation of a contract being stored on-chain (Kempe, 2017). So, although the contracting is primarily not implemented via blockchain, it is the combination of on-chain and off-chain components which supports bilateral contracting without government involvement, as expected for NPG.

Also, according to the three interviewees, informal processes are expected to be required within a blockchain-based public service delivery system. The projects' use cases, however, did not attempt to implement informal processes via blockchain. Those processes, e.g. legal counseling or discretion for decision-making, remained outside the blockchain. There is no evidence that the handling of informal processes has changed because of a blockchain implementation. This is not surprising since blockchain depends on upfront-coded transactions. Spontaneous and flexible human behavior could hardly be supported by blockchain alone, if this behavior is not covered by the coded rules of the blockchain solution. This may require additional technologies, such as artificial intelligence, to facilitate the automated decision-making process and, thereby, increase the flexibility of a blockchain system. If informal processes remain in place, i.e. outside the blockchain solution, the three PAs in scope of this analysis should carefully evaluate and design their decision-making processes and elaborate the interfaces of the formal and informal processes to avoid premature decisions to be put on blockchain.

4.6 Conclusion

The research presented within this article aimed to identify the relevance of the NPG paradigm to the design of public blockchain solutions. The analysis of the projects shows that blockchain-based public service delivery partly meets the various expectations associated with NPG.

First of all, dependence on three public administrations for service execution decreases, largely due to the shift of ownership toward non-public actors. This increases the flexibility of those actors and leads to relatively decentralized service execution. Efficiency improvements on both the public and non-public side, as well as trust gains for non-public actors, can be realized. Nonetheless, it was shown that a blockchain implementation does not necessarily involve any additional leverage of non-public resources. Strategy and design activities, in particular, remained core responsibilities of the analyzed PAs. With respect to the investigated projects, public and non-public actors did not jointly decide on strategy or design matters for public service delivery in the sense of NPG.

Second, it can be concluded that the reviewed PAs did not intend to become "one player amongst many others" (Kennett, 2010, p. 20) because they continue to believe in the key responsibility of public administrations to guarantee trusted public services. Despite the question of whether NPG could be realized with blockchain, it should be noted that it can hardly be assumed that NPG is currently being implemented within the three PAs. Hence, the realization of NPG could become even more challenging for the PAs with blockchain. With a growing number of stakeholders, governance efforts are likely to increase since there are multiple stakeholders involved at a technical level. It shows that the challenge faced by the PAs in retaining their digital sovereignty is to keep "full knowledge and control… about who can access ones data and where ones data are transferred." (Posch, 2017) Accordingly, the reviewed PAs call for a regulatory framework which sets binding roles and responsibilities for all parties, including international ones. Also, the shared responsibilities in the Zug and Malta projects, where non-public ICT providers mainly allocate their ICT infrastructure capacities utilized by the PAs, bears the hallmark of the government-as-a-platform concept (O'Reilly, 2011).

And third, the interviews showed that smart contracts alone seem to play only a limited role in today's projects. Instead, it was the combination of on-chain and off-chain components that ensured expectations regarding NPG and contracting could be met. However, the projects' results also demonstrated that public services did not become less or more informal due to the use of blockchain.

There are also limitations to the results of this research. It is not feasible to claim that the results are representative, as only three early-stage projects were involved in the review. Nonetheless, it was reasonable to strive for an explanatory approach due to the fact that blockchain is a relatively new technology and that it was being combined in an innovative way with the promising NPG paradigm.

The results of this research offer multiple opportunities for further research. For each analyzed use case, i.e., transfer of land titles, issue/authentication of education credentials and proof of residency, the results could be compared with similar blockchain implementations in other regions. Understanding the different implementations of the same use case, offers the chance to derive e.g. best practice or common issues in the area of blockchain governance, and thereby enhances this article's results. Especially with respect to the Swiss use case on proof of residency, it seems useful to further connect this with ongoing efforts of the European Union towards an European Self-Sovereign Identity Framework as part of the European Blockchain Services Infrastructure (European Commission, 2021). A strong connect between national and international activities may be beneficial for both parties in terms of efficiency and knowledge sharing. International activities, in particular, rely on insights from country level to support technological adoption and user acceptance of potential future solutions.

Also, the concept of NPG may be fruitful for the relatively new scientific community that is forming around blockchain. Following the scientific discussions on and challenges faced by concepts such as NPG could offer insight into the challenges of usefully implementing blockchain (Reijers et al., 2016). For example, what future skillset will be required in public servants who are expected to work in a collaborative manner? This issue was raised by the Maltese interviewee and considering existing research from public administration scholars may help to address it (Crosby, Bryson, & Stone, 2010). At the same time, blockchain offers great potential for process integration. Hence, it seems worth investigating whether the NPG paradigm with its emphasis on decentralized public service delivery could be further enhanced by the technology-enabled integration mechanisms (Torfing et al., 2020) of blockchain or other distributed ledger technologies.

Additionally, comprehensive approaches to blockchain governance are required in order to allow public administrations to master the increased complexity of governance brought about by the use of blockchain. Without a convincing, multi-stakeholder approach, NPG or blockchain may very well not proliferate as hoped by blockchain enthusiasts. This also applies to ongoing discussions around the compatibility of blockchain and GDPR (Berberich & Steiner, 2016), which could now be extended. Also, it may be useful to repeat this kind of research once there are public sector blockchain solutions that have been in production for some time in order to see how the public service develops over time and what decisions were taken to answer the questions raised in this article.

4.7 Contribution to overarching dissertation

This article provides multiple contributions for this dissertation. First, the article builds upon a case study approach which so far has been scarce in this field of interest. Interviews with project responsibles of leading European blockchain implementations in the public sector helped to gather insights first-hand. This approach, thereby, allowed to substantiate the discussion on blockchain's impact on public governance respectively public administrations and, for example, elaborated on the shifting dependency on and role of public administrations.

Also, the article delivered insights into concrete benefits and limitations of blockchains for public administrations, such as perceived efficiency improvements respectively trust gains or the limited importance of smart contracts. Researchers could pick up and further elaborate on these results. Public responsibles could also leverage the results for future discussions and decision-making.

5. Shifting Stakeholder Powers in Blockchain-Based Public Service Delivery

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5.1 Abstract

Power relations within the area of blockchain governance are complex by definition and a comprehensive analysis that links technological and institutional elements is missing to date. The research that is presented with this article focuses on the visualization of the shifting power relations with the introduction of blockchain. For this purpose, the analysis leverages an adjusted version of the multi-stakeholder influence mapping tool. The analysis considers the various stakeholders within the multi-layered blockchain technology stack and compares three fundamental blockchain scenarios, including public and private blockchain settings.

The findings show that public administrations face indeed less power with the introduction of blockchain, while new stakeholders come into play who wield influence rather uncontrolled. Nonetheless, public administrations are not powerless overall and remain influential stakeholders. This paper concludes that blockchain governance is not as democratic as blockchain enthusiasts tend to argue and derives corresponding opportunities for further research.

5.2 Introduction

Public administrations and political representatives regard joint efforts between public and non-public stakeholders to produce public services as increasingly important. This is a reaction to pressing topics resting inside and outside public administrations, such as scarce public funds, limited internal resources, eroding trust of society and challenges of globalization. A prime example for the current need of collaboration between public and non-public stakeholders is the ongoing global health crisis due to COVID-19. Observed governmental responses (e.g. (German Federal Government, 2020)) actively ask for a close collaboration between public health authorities and citizens with combined resources in order to co-produce public health services. In general, this governance-focused paradigm is often referred to as New Public Governance (Osborne, 2010). A successful implementation of this paradigm also requires the ability to cope and align with multiple involved stakeholders.

There are already various solutions of information technology (IT) available to support collaborative modes of working. However, the technology of blockchain takes the discussion of scholars and practitioners to another level because this technology is attributed to act as an institutional technology (Campbell-Verduyn, 2018b). Scholars of IT often claim it could fundamentally redefine stakeholder interactions by offering secure peer-to-peer working styles and thereby even improve democracy (Fisher, 2012). Advocates of blockchain also question the role of public administration. At the same time, the discussion around the institutional consequences of blockchain is rather unstructured. It is the technological complexity and the high number of relevant stakeholders on governance level that makes it difficult to understand the technology itself and corresponding power relations. For this reason, further research is demanded that links technological and institutional perspectives (Ølnes et al., 2017).

The research presented with this article aims to structure and visualize the shifting power relations in the area of blockchain governance by applying comprehensive stakeholder analysis techniques, such as multi-level stakeholder influence mapping tool (Sova et al., 2015). Furthermore, the research seeks to evaluate possibilities and limitations of public administrations to influence the development of blockchain-based public services.

This article summarizes the efforts and results of this research. First, the theoretical foundations of this research are laid out with an overview of interorganizational public service delivery and the blockchain technology. Second, the design of this research is introduced in greater detail by describing the applied step-by-step approach. Third, major findings are then examined and discussed. And finally, conclusions are drawn with respect to the aim of this research before limitations to the results and opportunities for further research are discussed.

5.3 Background

This chapter elaborates on the theoretical foundations of this article. First, the shift from intraorganizational towards interorganizational governance is presented and amplified with a discussion on the role of power and e-governance. Second, the foundations of the blockchain technology are introduced. These also include elaborations on the matters of blockchain governance and the technology's multiple stack layers.

5.3.1 Public service delivery – towards interorganizational governance

Public administrations offer public goods and services to their various stakeholders and expect them to follow their rules and to pay tax. The public administrations do so as they largely rely on laws and potential penalties these may include (van Waarden, 2012). They provide those goods and services with limited capacities. Especially time, funds and knowledge about the interdependences of service provisioning are scarce (Schedler & Proeller, 2011; Torfing, Peters, Pierre, & Sørensen, 2012c). Latter limitation should not surprise when multiple stakeholders are involved or even national boundaries are crossed (Moynihan et al., 2010) in consequence of e.g. technologies that know no borders or supply chains that easily span across nations (Kooiman et al., 2008; Lynn, 2010). Additionally, private actors increasingly engage as public service providers (Torfing et al., 2012c). Thus, the number of elements of a public service increases which makes it harder to predict and control the service outcomes, i.e. the complexity increases (Axelrod & Cohen, 2000; Wagenaar, 2016).

As one of the most recent and popular public sector reforms, New Public Management fails to offer adequate responses to these constraints due to its intraorganizational focus on efficiency (Liddle, 2018). Accordingly, new approaches are required that consider the shifting roles (Torfing, Peters, Pierre, & Sørensen, 2012e) and tackle the growing interorganizational governance efforts within the public service delivery system (Moynihan et al., 2010). Collaborative forms of governance have thereby gained significant importance in public sector reforms (Christensen & Lægreid, 2012) because traditional patterns of policy making, e.g. top-down decision-making or confrontation, appear to be hardly suitable for recent challenges (Innes & Booher, 2004). These forms seek to resolve conflicts and facilitate cooperation among public and non-public stakeholders (Ansell, 2012) in order to improve efficiency and quality of public services. This governance-focused paradigm is also referred to as New Public Governance. With New Public Governance, public and non-public stakeholders combine their resources to provide public services in co-production (Osborne, 2010).

Indeed, this would be a promising development. At the same time, this development presents "a challenge to the role of government" (Liddle, 2018, p. 972) which requires careful examination. When activities are not provided by public administration any longer, but instead by non-public stakeholders, this raises concerns in terms of e.g. accountability, legitimacy (Liddle, 2018) or governability of the societal system (Kooiman et al., 2008). There are many factors that could influence this complex governance system and which can only be partly controlled by the governing system (Kooiman et al., 2008). Stakeholders are likely to bring in diverging sets of e.g. goals, capacities, interests and dependencies (Moynihan et al., 2010). This may give reason for "conflicts and power issues" (Agranoff, 2006, p. 61) leading to challenging coordination and balancing efforts (Elsner, 2004) to finally jointly provide public services. Companies could either struggle in case they have to follow divergent laws of multiple jurisdictions or assume a superior role if they can rely on a large-scale organization and corresponding resources, while latter scenario is rather common practice and not theoretical thought experiment (Elsner, 2004). In summary, effective strategies for coordination and cooperation in governance networks are essential to prevent unbalanced actions, the abuse of power by stakeholders or an inadequate provision of public services (Klijn & Koppenjan, 2014).

Consequently, power and influence are two important factors in governance networks. The two concepts are closely linked with each other but still can be clearly distinguished. Both concepts strive for the achievement of one's actor interest. In contrast to the power, influence can achieve the interests without any forces or sanctions (Hoffmann-Lange, 1989; Schiffer, 2007). Using power always means to rely on a basis of power, e.g. knowledge, resources (Sova et al., 2015) or authority. Interestingly, where power and influence lie and how they are "conceived in studies of governance and institutions is often not discussed." (Sova et al., 2015, p. 383) This issue needs to be tackled when stakeholders apparently play an increasing role in governance networks. It can help to better understand stakeholder relationships within governance networks and, subsequently, support the design of proper governance models (Sova et al., 2015).

The analysis of stakeholders in governance networks that follow the concept of New Public Governance should also consider the use of IT. Electronic government is widely integrated in today's governmental processes of policymaking and policy implementation (Homburg, 2018). Thus, transforming a public administration would go along with a complementary transformation of IT. The benefits of IT for governance purposes, or e-governance, is already being discussed today. There are claims e-governance could result in intrinsically changed relationships in society and "help to achieve democratic means and even transform people's social and political consciousness." (Netchaeva, 2016, p. 469) Furthermore, e-governance should e.g. increase the efficiency, the accessibility of data and also enable a power shift from governments to individuals (Fisher, 2012).

Interestingly, the idea of conflicting interests and powers relations within collaborative governance networks to provide public services needs to be expanded onto the technology level (Fisher, 2012). The more stakeholders are involved with their own IT capacities, the higher the overall dependence on these IT assets (Elsner, 2004). And due to high complexities in IT provisioning (e.g. cloud-based public services operated by third parties in data centers across the world), it is hard to tell where power lies in the end (Fisher, 2012). Elsner (Elsner, 2004) already claimed years ago that an analysis should focus on the roles of power. This claim still holds true because the rather new technology of blockchain raises high hopes to fundamentally change the interactions among stakeholders. Does the introduction of blockchain represent a shift in powers for the provision of public services? In which direction – vertically and horizontally?

5.3.2 Blockchain – the institutional technology of governance

Blockchain is a distributed ledger technology which allows to securely transfer digital assets of any kind from one user to another in a peer-to-peer fashion. Thus, it can be applied to a variety of fields of application (Swan, 2015). The most prominent use of blockchain can be observed within the field of cryptocurrencies, e.g. Bitcoin or Ether as being two well-known cryptocurrencies. Essentially, blockchain is a network of nodes that stores continuously updated and synchronized data based on predefined rules every node agreed to. Self-executable programs, so-called smart contracts, further improve the efficiency of transactions (Finck, 2019) and reduce the need of human intervention.

Although blockchain is described by an alternating number of characteristics (Seebacher & Schüritz, 2017), there are four essential characteristics which in combination build the strength of this technology (Brinkmann & Heine, 2019): immutable data as a result of cryptography and the unique design of blocks, decentralized and bidirectional exchange between users without an intermediary, consensus among nodes that the stored data is accurate and a transparent history of all transactions (Brinkmann & Heine, 2019).

Furthermore, blockchain is not a monolithic system. It rather is an ecosystem of multiple, interconnected layers (Finck, 2019). There are different approaches to organize the layers depending on whether it should only entail technical layers or also institutional layers (Rikken, Janssen, Kwee, Bolívar, & Scholl, 2019). With regard to this article's aim, it was decided to rely on the technical layers. The sum of all technical layers will be called blockchain technology stack (Pignatelli et al., 2019; Shermin, 2017) in the following. Table 12 introduces the layers of the blockchain technology stack and presents a brief description per layer.

Table 12: Layers of the blockchain technology stack

Technology stack layer	Brief description
Application	This layer sits on top of the blockchain layer and includes so-called decentralized applications (DApps) and supporting application frameworks. DApps are stored on the blockchain and executed by the nodes (Finck, 2019). Stakeholders at this level can be e.g. software developers or end users.
Blockchain	This layer essentially includes the consensus mechanism of the blockchain network (Davidson, Filippi, & Potts, 2016b; Finck, 2019), e.g. proof-of-work or proof-of-authority. It contains the rules how transactions are validated and subsequently stored by the nodes (Rikken et al., 2019). Also, fundamental characteristics of a blockchain network, such as permissionless access, can be

Technology stack layer	Brief description
	assigned to this layer. Stakeholders at this level can be e.g. node operators or core software developers.
Internet	This is the bottom layer. It is crucial for the blockchain network which requires constant internet connectivity in order to operate properly (Filippi & Mcmullen, 2018). Stakeholders at this level can be e.g. internet service providers or public administrations in the role of regulators.

The essential blockchain characteristics of this multi-layered network have been leading to an increasing interest in blockchain among scientists and practitioners (D. Meijer & Ubacht, 2018). Because blockchain represents a fundamental change of user interaction and its presumed impact on common roles, with intermediaries being potentially eliminated (Rueda et al., 2020), this technology is perceived as an institutional technology of governance (Davidson et al., 2016b). Intermediaries, it is argued, may often leverage information asymmetry out of self-interest or in "inefficient, or corrupt ways." (Kim, Laskowski, & Nan, 2018, p. 2) While blockchain is thus presented as the solution to these issues, others argue (e.g. (Golumbia, 2015)) the introduction of blockchain may give rise to new challenges to overcome self-interest of stakeholders.

In general, potentials to use and participate in a blockchain network depend on configuration where two fundamentals can be distinguished. A public and permissionless blockchain solution (e.g. Bitcoin or Ethereum) is open to any individual or organization that wants to use, operate or further develop the network for their individual reasons. A public blockchain can be accessed globally, not bound by borders, which makes it hard for single public entities to enforce the law of their own jurisdiction. Adequate governance of this network appears to be challenging due to its open nature (Atzori, 2018). In contrast to public blockchains, private blockchains seem easier to handle in terms of governance. They rely on central authorities, normally the owners of the networks organized in a consortium, who have the say when it comes to fundamental decisions and they also decide on user access and privileges (Finck, 2019; Ølnes et al., 2017). But it is precisely the centralized setup which leaves room for criticism since it could be interpreted as a contradiction to blockchain's idea of decentralization (Finck, 2019). However, owners rely on the private setup in hope for efficiency gains (Finck, 2019) and increased governability (Atzori, 2015).

There is a larger consensus among scientists that the choice to go for a public or private blockchain influences the governability of a blockchain network. However, this is a rather vague conclusion of the institutional consequences and the roles that are likely to change. Proper scientific analyses are rare to date. This is not surprising because most scientists still focus on cryptocurrencies and technical issues of blockchain (D. Meijer & Ubacht, 2018). Therefore, it is argued in favor of further assessments (Atzori, 2018; Klischewski, 2018). This seems necessary to better understand the effects on governance associated with the selection of either private or public blockchains and to pinpoint "risks and drawbacks" (Atzori, 2018, p. 7), wherever they occur. This could provide hands-on orientation to scientists and practitioners alike and contribute to the discussion on blockchain governance models.

Blockchain governance essentially refers to two principles: governance by blockchain and governance of blockchain (Filippi & Mcmullen, 2018). When blockchain is leveraged to govern non-technical, functional processes (e.g. collaborative public services between a public administration and its citizens) or organizations, this governance is achieved by the use of blockchain. Blockchain itself requires its own governance structures and processes because it is in a constant process of development, operation and maintenance (Ølnes et al., 2017). This is referred to as governance of blockchain. Governance decisions affecting the blockchain network can have an impact on the qualities of governance by blockchain.

On-chain or off-chain procedures can be applied to implement governance by or of blockchain. On-chain governance refers to technical rules directly embedded into the code allowing a more efficient and strict way of implementation (Filippi & Mcmullen, 2018; Finck, 2019). For instance, rules embedded on the blockchain layer will be mandatory for the upper application layer and its DApps and frameworks. Processes and other forces of off-chain governance, however, affect a blockchain network and its stakeholders from the outside (Filippi & Mcmullen, 2018). These forces, e.g. national laws or informal rules of communities, "operate at the social and institutional level, rather than at the technical level." (Filippi & Mcmullen, 2018, p. 18) Consequently, the human factor comes into play which makes off-chain governance more complex and less predictable than on-chain governance.

The social and institutional factor at governance level presents a challenge to blockchain networks. The initial intention of blockchain enthusiasts was to take away power from centralized stakeholders and distribute the power to many other individuals (Finck, 2019), "enabling a more even distribution of power and wealth… [and leading] to increased participation and public engagement." (Filippi & Mcmullen, 2018, p. 6) This belief is to be challenged with respect to the stakeholders at each blockchain stack layer. Governance of blockchain partly requires new roles, e.g. core software developers of public blockchains, that coexist with established roles. So, there might be a shift of power from today's centralized stakeholders. But this brings up two questions: How much power is shifted really? Are there new powerful centralized stakeholders instead of an even distribution of power?

Some scientists already estimate that blockchain networks could give rise to oligarchies at technology level (Filippi & Mcmullen, 2018; Klischewski, 2018; Rozas, Tenorio-Fornés, Díaz-Molina, & Hassan, 2018) who could ultimately impact non-blockchain related, functional or political governance decisions. Power would be "still divided unequally." (Reijers et al., 2016, p. 140) It is the aim of this article to examine these claims by a clear presentation of possible new power relations in blockchain networks

5.4 Methodology

This chapter introduces the methodology, including a step-by-step process description. This methodology is built on multiple complementary tools of stakeholder analysis. It is this mix of tools that allows to achieve this article's aim of structuring and visualizing shifting power relations among stakeholders.

It was concluded in the previous chapter that stakeholder analysis is often neglected within governance sciences. Not surprisingly, the number of tools for practitioners and researchers alike to understand power relations and define appropriate measures (Sova et al., 2015) to shape governance models is limited. Within the area of stakeholder analysis, however, the decisional method provides a promising approach to gain this understanding by considering qualitative data and investigating "power according to [stakeholders'] participation in decision-making." (Servou, 2016, p. 16) This method contains tools like the power versus interest grid, bases of power and direction of interest diagram and the stakeholder influence mapping (Servou, 2016). It is the adoption of latter by Sova et al. (2015), in particular, that offers a valuable methodological foundation for this article's research – the Multi-level Stakeholder Influence Mapping (MSIM).

Similar to the stakeholder influence mapping (SIM), MSIM seeks to analyze the relationship of stakeholders or stakeholder groups towards a decision-making scenario or policy focus “within complex system regimes.” (Sova et al., 2015, p. 384) It does not primarily aim at investigating the relationship among stakeholders. These relationships are only relevant by extension (Sova et al., 2015). The influence of one stakeholder on the policy focus is of particular interest (Mayers & Vermeulen, 2005). The enhancement and great advantage of MSIM over SIM lies in its ability to create an comprehensive view on one policy focus spanning across multiple stakeholder levels (Sova et al., 2015).

Depending on the level of aggregation, results of the stakeholder analysis merge into one or more visual maps, each containing individual stakeholder characteristics, including the relevant stakeholders and their group size, “the degree of influence that they hold over the [scenario], and their relationships with each other.” (Mayers & Vermeulen, 2005, p. 2) The closeness of stakeholders to one another displays the degree of potential conflict or cooperation (Sova et al., 2015).

To gather those stakeholder characteristics, the commonly used step-by-step approach needs adjustments to meet the article’s aim in response to the low number of available blockchain implementations in the public sector. The original interview-based approach which would allow to identify stakeholders, their group size and influence is, thus, replaced by a comprehensive desk research in combination with the additional use of tools of stakeholder analysis. The following adjusted, stepwise MSIM approach was applied for this research:

Step 1: Define policy focus. The policy focus reflects the overall issue in scope (Mayers & Vermeulen, 2005) of this research. The influence of stakeholders is measured by the stakeholder’s influence on the policy. Because this research seeks to compare blockchain and non-blockchain scenarios, the policy focus needs to be framed more general and not exclusively to meet blockchain scenarios. Consequently, the policy focus for this research is phrased "Establishing and making adjustments to domestic public service".

Step 2: Define scenarios. Scenarios are usually defined to understand the development of stakeholder influence on a policy focus over time (Sova et al., 2015). In this research, those scenarios are derived from the three fundamental options to use or not to use blockchain: Private blockchain, public blockchain and conventional use of IT, i.e. no blockchain is used.

To increase the usability of this research's results, existing blockchain implementations were considered. With respect to the private blockchain, the Swedish Mapping, Cadastral and Land Registration Authority implemented a solution to transfer land titles. The public blockchain scenario is represented by the Ministry for Education and Employment of Malta that implemented a solution to issue and authenticate educational credentials. The conventional scenario is based on characteristics of the IT of both the Swedish and Maltese public administrations (e.g. use of cloud services by third parties) gathered by literature research to support a before and after comparison as realistic as possible.

Step 3: Identify appropriate stakeholder levels. As shown with section 2.2, the blockchain network is not a monolithic system. It rather consists of three essential stack layers, i.e. application layer, blockchain layer and internet layer. These stack layers can be applied to the private and public blockchain scenarios. Correspondingly, appropriate layers for the conventional scenario are application layer, public administration infrastructure layer and internet layer. Latter layer refers to the same layer as within the blockchain scenarios. In contrast to blockchain's decentralized application layer, the conventional application layer is rather focused on centralized applications. Additionally, the public administration infrastructure layer is founded on the widely exercised Do-It-Yourself approach of public administrations to run their own IT development and operations units supported by third parties.

Step 4: Identify stakeholders. An extensive literature review on (non-)blockchain stakeholders was conducted. The literature revealed a wide range of stakeholders for blockchain in general, but some of them appeared not be relevant for the respective scenarios. Only stakeholders relevant for at least one scenario were considered going forward and mapped to each scenario and layer, if applicable. Results were noted in a stakeholder list.

Step 5: Estimate group size. For each relevant stakeholder, the group size was estimated and classified in categories of "smallest", "small", "big" and "biggest". The information per stakeholder was added to the stakeholder list.

Step 6: Determine stakeholder influence and relationships. This is a key step of this methodology and a divergence from the conventional MSIM methodology. Instead of relying on interviews to gather opinions from individuals, there was another extensive literature review conducted on the relevant stakeholders. The aim was to explore and structure the broader scientific opinion on the interests and power base of each stakeholder at each stack layer in each scenario by leveraging the "bases of power and directions of interest" tool (Bryson, Patton, & Bowman, 2011). There are especially the bases of power, e.g. in the shape of coercion, legal force, knowledge or resources (Eden & Ackermann, 1998; Sova et al., 2015; Torfing, Peters, Pierre, & Sørensen, 2012a), that decide whether a stakeholder is rather likely to safeguard its interest compared to other involved stakeholders. This is crucial to substantiate the decision on a stakeholder's influence (Bryson et al., 2011). Furthermore, possibly identified similarities or differences between stakeholders can be used to estimate the closeness among them. The stakeholder information on power and interests was then again added to the stakeholder list.

Step 7: Assign stakeholder ranking. This step involves the assignment of a relative ranking to a stakeholder within each scenario and stack layer. This assignment is based on the evaluation of the different bases of power and directions of interest of each stakeholder. A stakeholder's influence on the policy focus is ranked higher, when this stakeholder e.g. has relevant legal authority to enforce its interests. In contrast, another stakeholder may be in a contractual relationship which rather coerces this stakeholder to follow the will of others. "The [stakeholder] placed lowest received a ranking score of 1, the second lowest a score of 2" (Sova et al., 2015, p. 398) and so on. Stakeholders can also receive the same ranking score. This variable is referred to as relative ranking (R). Once the assignment is completed, influence maps per stack layer can be created.

Step 8: Calculate influence score. The influence score (InfS) is the most relevant stakeholder variable for this research. The influence score is an aggregated variable answering the question what the overall influence of one particular stakeholder is on a scenario – regardless of the frequency this stakeholder was identified as relevant in a scenario. Because the number of stakeholders can vary across stack layers in a scenario, it is important to transfer the relative rankings of a stakeholder into an adjusted ranking score (Ra) on scenario level. This is the base to calculate the influence score of each stakeholder. At the end of the calculation, the influence map per scenario level can be created.

Step 9: Compare scenarios. In order to understand the changing power relations across scenarios, an adequate method to compare the stakeholder influence across scenarios was designed. Instead of adding another number to this qualitative research, it was decided to use a qualitative scale ranging from "High influence" at the top to "Low influence" at the bottom. This scale was applied to the calculated influence score derived within step 8.

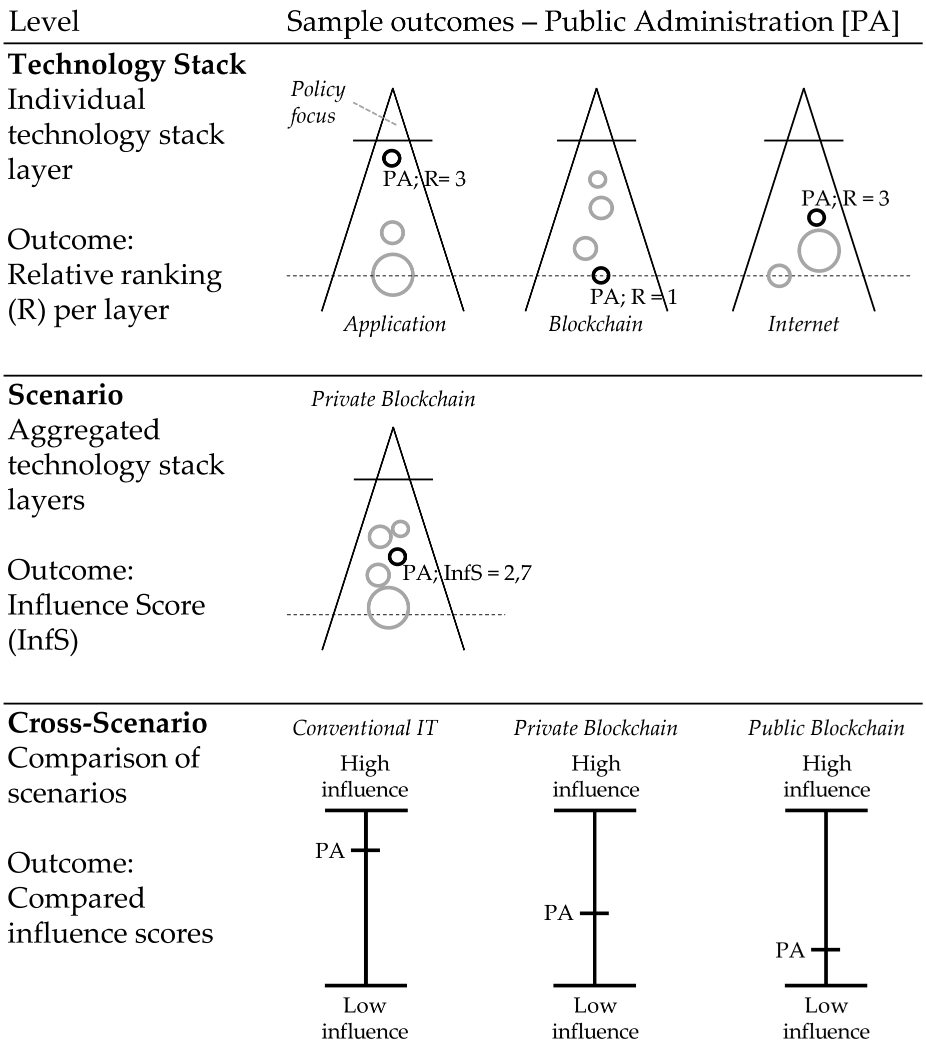


Figure 4: Evolving influence analysis from bottom to top level

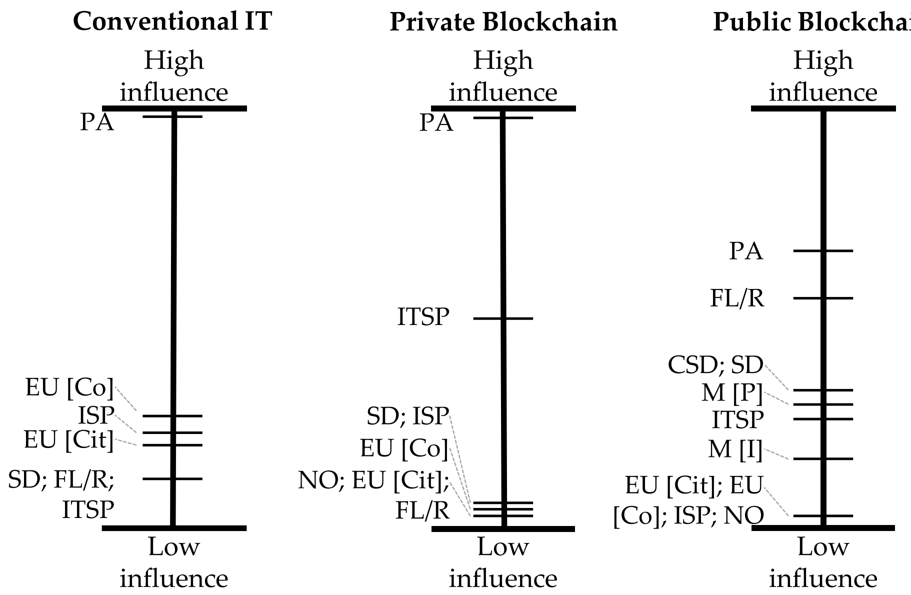
In summary, this approach not only provides insights into each stack layer, but also allows an aggregation from the bottom to the top. Figure 4 illustrates the expected result types for each level and how those result types are linked between the levels.

5.5 Results and discussion

This chapter presents the major results obtained by applying the methodology presented in the third chapter and puts them into perspective. More details on all relevant stakeholders and scenarios, including influence maps, influence scores and rankings, are provided as supplemental files alongside this article.

The results of this research show that there are eleven relevant stakeholders to consider across all three scenarios. The composition reflects the different roles within a scenario and stack layer, and diverging characteristics of a stakeholder. For example, it was decided to split “end user” into two stakeholder groups consisting of “end user (citizens)” and “end user (company)” due to significant differences in group size and bases of power, which could impact the analysis.

The data of this analysis shows that the number of relevant stakeholders varies across all scenarios and stack layers. Most stakeholders could be identified within the public blockchain scenario whereas the conventional IT scenarios contains the least number of stakeholders. Also, stakeholders are not constantly relevant within and across scenarios, although the frequency of appearance does not necessarily correlate with the stakeholder’s overall influence. Interestingly, even the group size of one stakeholder can fluctuate depending on the scenario. Thus, a particular group size should not be taken for granted when designing governance models.

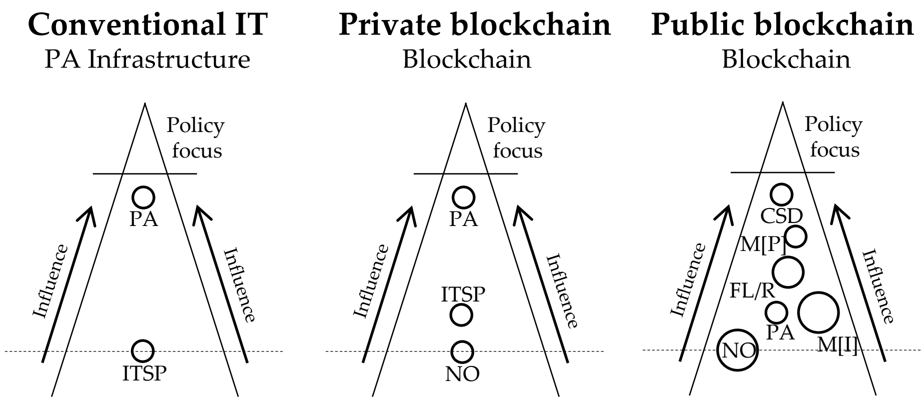


Key (Stakeholder)

CSD	Core Software Developer	ITSP	IT Service Provider
EU [Cit]	End User [Citizen]	M [I]	Miner [Individual]
EU [Co]	End User [Company]	M [P]	Miner [Pool]
FL/R	Foreign Legislator / Regulator	NO	Node Operator
		PA	Public Administration
ISP	Internet Service Provider	SD	Software Developer

Figure 5: Comparison of stakeholder influence across scenarios

For public administrations, opportunities for decision-making constantly decrease from the conventional IT, through the private to the public blockchain scenario (see Figure 5). This is understandable because they gradually lose ownership of IT and other stakeholders can make decisions on issues that were formerly solely decided by public administrations. This is especially true with respect to the public blockchain of Malta. In this public blockchain scenario, the Maltese public administration can hardly influence what decisions should be made and how this should happen. Large stakeholder groups, mainly positioned outside the Maltese jurisdiction, make it difficult for the Maltese public administration to ensure its demands are considered. On the blockchain stack layer, in particular, other stakeholders, i.e. core software developer, mining pools and foreign regulators, seem to set the agenda (see Figure 6). This is a major change compared to the conventional IT scenario.



Key (Stakeholder)

CSD	Core Software Developer	M [P]	Miner [Pool]
FL/R	Foreign Legislator / Regulator	NO	Node Operator
ITSP	IT Service Provider	PA	Public Administration
M [I]	Miner [Individual]		

Figure 6: Comparison of the middle layers of the technology stack

Overall, public administrations seem to have less power but they are not powerless. Because the Swedish and Maltese public administrations could act on all stack layers to a certain extent, makes them influential players nonetheless. In contrast, end users (citizens and companies) only play a minor role, if any, when it comes to influencing blockchain-related events or taking part in decision-making processes. Apparently, civic end users cannot leverage their sheer group size to push their manifold interests.

Finally, IT service providers gain influence from their valuable resources and capacities they bring in. Public administrations struggle and hesitate to recruit such specialized and rare professionals. IT service provider fill this gap and act as co-producers of public services (Torfing, Peters, Pierre, & Sørensen, 2012d).

5.6 Conclusion

The research presented with this article aimed to gain a deeper understanding of the shifting power relations within the area of blockchain governance to deliver public services. For this purpose, the power relations among relevant stakeholders were visualized and the possibilities and limitations of public administrations, in particular, to influence the development of blockchain-based public services evaluated.

The results allow a tangible picture of the shifting power relations, as intended. It was shown that public administrations are not powerless in any scenario. Compared to conventional IT solutions, however, their possibilities decrease especially with the use of public blockchains. Furthermore, limitations in decision making on all layers of the blockchain technology stack became apparent. Public administrations would need to enter into transnational partnerships to effectively increase the influence on public blockchains.

The results indicate that public administrations should rather leverage private blockchain solutions if they are interested in keeping control. At the same time, private blockchains could mean higher initial costs because of additional efforts to set up consortium partnerships and the need for dedicated IT infrastructure. From a research perspective, a rising number of private blockchains increases the importance of interoperability to interlink private blockchains and, thereby, strengthen the usability of blockchain-based solutions.

The decision to either use private or public blockchains is not only a technical one. It may also impact the development of public services based on collaborative governance. Public blockchains, especially Bitcoin, are not tools to support truly democratic governance procedures. As long as citizens, who represent the largest stakeholder group by far, have little or no opportunity to participate in this development, the development of blockchain networks remains a task of a few, privileged stakeholders. For the time being, public administrations could make a difference by choosing private blockchains and designing more inclusive governance models. Consequently, further research should elaborate on the ways to include citizens or adequate representatives in the process of blockchain governance.

Although this research was carefully conducted, there are two limitations to the findings. First of all, the data basis for the presented results is only partly empirical. There are very limited implementations within the public sector available which consequently narrows the experience of relevant stakeholders with matters of blockchain governance. Second, the calculation of the stakeholder influence scores is the result of qualitative methods of stakeholder analysis. As with any other qualitative method, this allows deviations with respect to the accuracy. To tackle both limitations, it is suggested to conduct interviews with relevant stakeholders, once available in sufficient numbers, to analyze the perceptions of those directly affected. This would allow the results of this research to be reviewed.

5.7 Contribution to overarching dissertation

This article offers two major contributions to the overarching dissertation. Until now, an adequate framework to assess stakeholder relationship was missing. This article's result supported a solution to this scientific gap. It leveraged an adjusted stakeholder influence mapping framework which allowed a rather detailed evaluation of power changes due to the use of blockchain.

The rather detailed understanding was supported by the various stakeholders, who were identified for multiple, partly empirical scenarios and were positioned among themselves within each scenario. It was the scenario comparison which subsequently allowed to derive a comprehensive understanding of power changes and to precisely depict them. This supported the answering of the dissertation's corresponding research question and, thereby, the achievement of its overall objective.

6. SYNTHESIS

This chapter provides a conclusion derived from the individual articles and puts the findings into perspective concerning stakeholder relations within public administration, as predefined by this dissertation's objective.

This dissertation's research effort was carefully designed and executed. However, as with any other scientific work, the presented results have restrictions that require careful examination. This chapter includes such a critical exam. These restrictions also present opportunities for further research. Research can also be driven by the results generated within this dissertation, with new opportunities for the construction-oriented science of information systems in the public sector. This chapter also discusses various potentials and lists starting points for further research.

6.1 Main results, implications, and contributions

This dissertation aimed to substantiate the theory and practice of blockchain-enabled New Public Governance. This section summarizes the findings and consequences of both perspectives and, additionally, lists the created contributions.

The combined use of theoretical and empirical methods demonstrated that the technology of blockchain can strongly support a public service delivery in the sense of New Public Governance. Blockchain especially supports inter-organizational horizontal coordination and can increase the societal involvement of stakeholders. Nonetheless, with the implementation of blockchain, the central control remains rather unchanged in theory and compared to today's reality of the investigated blockchain-less public administrations. Considering these results, it is apparent that blockchain alone cannot fully enable New Public Governance for public service delivery. That said, it may be questionable if an idealized implementation of New Public Governance is realistic when it co-exists with other public governance paradigms.

Another major finding can be assigned to the area of blockchain governance. The relationship of public administrations with other stakeholder changes at the technology level. This research allowed a differentiated positioning of public administrations among stakeholders in terms of the influence they have. Due to this substantiated and differentiated picture, it becomes evident that public administrations constantly lose influence from private blockchains to public blockchains, whereas they dominate relationships in scenarios without blockchain. Public administrations remain the most powerful stakeholders overall due to their comparatively good opportunities and strong influence over other stakeholders across the blockchain technology stack layers. However, as this research illustrates, some roles within a public blockchain ecosystem are privileged, while others are underprivileged. Thus, equality among stakeholders is not a given and raises questions on potential legal and regulatory consequences to balance chances and risks for each stakeholder. For public administrations and their decreasing influence, this perceived inequality is another issue, alongside cloud computing for governments, in the context of digital sovereignty (Irion, 2012; Posch, 2017).

Thus far, scientists have focused on individual stakeholders, for example core software developers, but fallen short on positioning the public administration. This dissertation contributed to the advancement of this research field. To obtain these new results, this research contributed a comprehensive stakeholder analysis for blockchain ecosystems. This type of comprehensive analysis and subsequent visualization has been lacking. The use of the Multi-Stakeholder Influence Mapping method, which is usually leveraged in the area of social sciences, answers the call of scientists for a framework to assess relationships within blockchain networks and strengthen interdisciplinary research by introducing this method in the area of public sector information systems. As a consequence, public administrations and regulators can better focus their discussions on regulation and blockchain governance frameworks (Ypma et al., 2020).

Results were also derived from real-life blockchain implementations. Blockchain can make only a partial contribution to the idea of New Public Governance. The case-studies demonstrated that real-life implementation did not lead to a mature New Public Governance-like public service delivery because co-production had hardly been achieved. Hence, the implementation of blockchain alone is not a guarantee for the introduction of New Public Governance to public administrations.

Two aspects are important to mention here: First, alongside the technical implementation of blockchain, a shift in the mindset of public administrations is necessary to implement the roles required for joint public service delivery. However, the public administrations interviewed had largely kept their traditional roles. All the interviewees emphasized the importance of maintaining responsibility for the public service's outcome, partly due to the perceived absence of alternatives. Shared responsibilities and clearly defined, also non-public, decision makers are preconditions for New Public Governance.

Second, stronger movement toward co-production and leveraging blockchain for this reason challenge the law and legal practices. Shifting activities from public administrations to non-public stakeholders could also represent a shift of accountability and thus needs proper legal reflection. This seems important, considering wide-ranging fields of application—including tax, health, or real-estate that represent either sensitive or high-value cases. Past digitalization efforts, for example, the German Online Access Act (BMI, 2020), have demonstrated the necessity to implement new or adjust existing constitutional or special laws, for example, regarding data protection (BfDI, 2020). It seems likely that the use of blockchain will require more efforts than it receives today, especially with respect to regulatory matters (Finck, 2019; Yeoh, 2017). Due to the cross-border nature of blockchain, it is plausible that legal efforts should focus on community, national, and supranational levels, similar to the recently completed negotiations on taxation of the global digital economy (OECD, 2021). Admittedly, adjustments to existing legislation seem reasonable to allow a shifting of tasks to non-public stakeholders and, thereby, implement a cooperating execution of tasks – even without the use of blockchain. Moreover, it could be investigated in which direction blockchain and its associated elements (smart contracts, DApps, etc.) may need to develop to conform with regional or cross-regional law (Werbach, 2018). These two aspects demonstrate the importance of holistic blockchain governance models if the ideas of New Public Governance and blockchain are to be further implemented in combination with each other.

Furthermore, this dissertation disclosed that the independence of non-public stakeholders has increased with the implementation of blockchain. Due to the shift of data ownership, citizens can interact without the interference of public administration. Thus, the immediate execution of public services benefited from blockchain. However, this benefit for citizens and other non-public stakeholders applied only to the execution of public service and did not affect strategic or conceptual matters of public service delivery.

The empirical results make manifold explorative contributions and present links to theoretical conceptions of blockchain and New Public Governance. The interview-based case study work and the Delphi method were rare empirical opportunities due to the relative newness of blockchain technology and the accordingly low number of mature blockchain implementations in public service delivery. These were first-time efforts to understand whether the motivation of public administrations and the implementation of blockchain moved stakeholder relationships toward New Public

Governance. The efforts thereby delivered insights into the status quo of today's blockchain implementations within the public sector which are generally scarce. In addition, it provided links to improvement potentials for practitioners and scientists to strengthen the idea of joint public service delivery based on blockchain.

6.2 Critical reflections on the research design

The research design provided valuable results which, nonetheless, need careful reflection. This reflection is structured along the dissertation's three research questions that represent the objective of this research work.

The first research question sought to answer in what ways the technology of blockchain fits with New Public Governance. One critical assessment should be ascribed to the complex, multi-disciplinary nature of this field of research. Public governance and blockchain governance are each complex due to the various involved stakeholders and the multi-dimensional implications on social, technical, or legal matters. Hence, the results of this research did not cover every aspect of research.

The complexity also lies in the transition from conventional to blockchain-based public service delivery, which was not a major focus of this research. This may, for example, involve the question of whether the preexisting governance structures of a public administration (Möltgen-Sicking & Winter, 2018) impact the blockchain solution design. Answers to this question could indicate the extent to which blockchain solution blueprints could work and the level of individualization required. Nevertheless, due to the described complexity, it seemed necessary to narrow the scope by following an explorative approach. The results provide insights and more clarity for this field of research. They offer the opportunity to identify future potentials of research and support practitioners to make holistic decisions.

The second research question observed today's changes to stakeholder relationships due to blockchain. The use of only a limited number of real-life public services use cases constitutes a limitation to the results connected to this research question. While this seems acceptable considering the explorative nature of this research, it could be argued that the results are not representative. The results cannot be considered representative but should be viewed as having been derived inductively. Results of this research might be unique to a particular public service or might over-emphasize other aspects that are less important for some public services.

By the nature of inductive reasoning, these results need to be validated by additional observations. For example, observations could either expand geographically by analyzing the same use cases in different countries and regions or include additional use cases within the public sector or cross-sector. The identification of such additional use cases may be challenging because there are only limited mature implementations available due to the young technology of blockchain.

The limited number of observed use cases should not lead to a disregard of the empirical work. Instead, it presents an opportunity to understand first-mover projects early on, link them with theoretical concepts, and contribute scientific insights for projects and other scientific work. Future research can pick up the results of this work and compare them with other projects. The results could even be used as a starting point for a long-term observation of these projects to understand their evolution.

The third research question investigated how the power of public administrations changes with the introduction of blockchain. This research positioned the various stakeholders holistically; therefore, leaving room for further expansion and validation. The generated results of this research could benefit from further analysis and be a starting point for research focusing on involved stakeholders, such as regulators or ICT infrastructure providers, by using an interview-based approach to assess scenarios, for example. A stakeholder-oriented assessment that also factors in a thorough analysis of past events, especially their behaviors and decisions, could enhance these initial holistic results. As outlined in the previous section, however, this novel approach to stakeholder assessment in blockchain ecosystems was based on a well-founded analysis and considered real-life blockchain scenarios which, in combination, supported the generation of value results.

6.3 Stakeholder engagement for blockchain-based public service delivery

All parts of this research revealed that the social component of the technical solution of blockchain plays a role in realizing a blockchain-based public service delivery. Hence, it is crucial to extend the scope and focus not only on technical matters (Traunmüller & Lenk, 2017). Further research should incorporate the manifold potentials of social matters (Torfing & Triantafillou, 2016b) to influence a blockchain-enabled New Public Governance. The social dimension was not central for this dissertation. Table 13 summarizes example research questions which could be pursued in the future.

Public and non-public stakeholders need to be involved in the transition toward blockchain-based New Public Governance. Today, they are not used to working in a collaborative fashion, but both public and non-public stakeholders will need to change their ways of working and interacting with each other (Möltgen-Sicking & Winter, 2018). It remains to be answered how stakeholders can be motivated to support this process of change on a large scale. With respect to the three investigated use cases in Europe, the public administrations did not plan to oblige non-public stakeholders to use the blockchain-based public service; instead, the conventional process continued to be available to the non-public stakeholders, which may limit the motivation of these stakeholders to participate. Public stakeholders should voluntarily support collaborative working to increase the chance of a lasting contribution on the part of individuals. Public stakeholders have been paying a great deal of attention to new legislation, and with good reason (Martini, 2018), but may need to expand their considerations to proper public service process designs.

Table 13: Potential research questions for blockchain-related stakeholder engagement

#	Potential questions for further research	Scope
1	What are specifics and hurdles to stakeholder engagement in blockchain-based public service delivery?	Challenges to stakeholder engagement
2	• What stakeholder engagement strategies are suitable to manage the transition toward blockchain-based public service delivery in the sense of New Public Governance? • Can strategies to stakeholder engagement in non-blockchain-related settings be applied?	Stakeholder engagement strategy design and selection
3	How effective were stakeholder engagement strategies of past real-life blockchain implementations in the public sector?	Empirical research

Stakeholder motivation should not be taken for granted (Martini, 2018). For non-public stakeholders, two aspects require particular attention. First, citizens and businesses require outstanding added value for themselves (Martini, 2018) before they will abandon a solution they are accustomed to. Consequently, affiliated research should investigate how important legislation is to foster this process, what a proper set of incentives for stakeholders should look like, and what arguments would persuade future users. This offering, it is argued (Misgeld, 2018), should also factor in the quantity of available blockchain-enabled public services. Additional research should pick up this argument and analyze the implications for non-public stakeholders. In a scenario where many public services are blockchain-enabled and designed according to the New Public Governance paradigm, the responsibility of each non-public stakeholder would further increase. Is data ownership for presumably dozens of public services manageable for citizens? Is the citizen willing to take care of their own data with all the larger-scale rights and duties this involves? The criteria of blockchain adoption (Fleischmann & Ivens, 2019; Knauer & Mann, 2020) and technology acceptance (Robra-Bissantz & Strahringer, 2020) should be examined in terms of these aspects.

6.4 Blockchain as an issue of digital sovereignty

Blockchain governance is another field for further research. The interview results and the work on power relations made clear that public administrations hesitate to foster the use of blockchain in public services as long as questions of responsibility and accountability on a technical level remain unanswered. Influence and power are shifting away from public administrations. As with any other significant technological change, this shift comes with changes to “social, economic, and legal processes” (Hacker et al., 2019, p. 2) which must be considered.

Governance models are already a pressing topic in blockchain research and may be the foundation for the further use and development of blockchain. For example, public administrations may not fully adopt blockchain interoperability improvements if doing so makes matters of responsibility and accountability more complex and unclear. In addition, today’s public blockchains are not attractive to public administrations because administrators have only limited confidence in the rightful handling of the data and their solutions. In fact, blockchain appears to be relevant for matters of digital sovereignty.

6.4.1 Fuzzy and vulnerable blockchain governance

Understandings differ as to what digital sovereignty means. In general, sovereignty is the ability to decide without any foreign interference (Pohle & Thiel, 2019). With respect to digital sovereignty, Fabiano (2020) identifies two interpretations. The first reduces digital sovereignty to the sovereignty of states alone (e.g., Schieferdecker & March, 2020; Ziolkowska, 2021) while the second puts sovereignty in a broader context by referring to any private or public stakeholder who could use the digital domain. For example, private stakeholders can be perceived with their different roles as consumers or users of digital assets (Pohle & Thiel, 2020). The second interpretation seems more inclusive because it considers the various stakeholders within the digital domain. It will, hence, be applied going forward.

The importance of digital data increases when it is used for social coordination. Accordingly, data handling must consider not only social processes but also appropriate technology and governance mechanisms (Zwitter & Hazenberg, 2020). This dissertation demonstrates the impact of digital data in the case of blockchain technologies and the changing stakeholder ecosystem that the use of blockchain implies. Involving and relying on external stakeholders may bear the risk of partly losing control (Fabiano, 2020), especially for states in areas where they have traditionally been in charge (Ziolkowska, 2021). The issue of potential loss of control to others may become more relevant for state and society with an increasing importance of technology (Kar & Thapa, 2020). Those who control hardware and software are in control of the conditions to use it (Bendiek & Neyer, 2020).

Interest in these matters has been rising for various reasons. Political stakeholders, for example, engage more actively due to an increasing awareness of the relevance of technologies for societies (Kar & Thapa, 2020). Furthermore, stakeholders realize that governance is challenged with the increasing complexity of expanding digital networks (Pohle & Thiel, 2019). In addition, digital transnational networks (Bendiek & Neyer, 2020) and their digital services and products are becoming part of geopolitics in international relationships (Kar & Thapa, 2020). International stakeholders realize the possibilities (Farrell & Newman, 2019) of influencing digital networks in their favor to prevail their interests over other stakeholders (Kar & Thapa, 2020; Leonard, 2016). This dynamic could already be observed in previous cases, for example, the Russian efforts of geo-blocking and storing nationally hosted data (Pohle & Thiel, 2019), "China's determined activism on internet governance" (Adonis, 2019, p. 262), and the potential American influence on cloud computing service providers.

Such events stimulated discussions in academics as to how the digital domain can be effectively governed or what the constellations of power look like (Adonis, 2019), acknowledging the current insufficient legal assertiveness of European state actors against non-European companies that might not share common European values (Kar & Thapa, 2020). This dissertation supports this academic exchange by highlighting the changing power conditions with respect to often internationally distributed, partly anonymous, multi-stakeholder blockchain networks and underlying infrastructure. Hence, the use of blockchain is an issue of digital sovereignty (Ziolkowska, 2021).

These concerns are in contrast to the general belief that blockchain is a trustworthy environment, a trust machine (Völter, Urbach, & Padget, 2021). Surveys illustrate numerous trust issues that companies face, with regulatory uncertainty or lack of trust being high priority issues among users (Momot et al., 2018). The combination of connectivity, complexity, and resulting contingence (Bendiek & Neyer, 2020) can make blockchain networks unpredictable. As a consequence, courts and regulators in various countries began to define regulations in attempts to influence stakeholders

(Hacker et al., 2019) such as miners or traders of cryptocurrency (e.g., BBC, 2021a, 2021b).

National activities can be placed in a field of tension of competing laws and political narratives, which seek either to enable and protect the libertarian ideal of the blockchain technology or constrain and foster a regulated blockchain technology (Hacker et al., 2019). This duality deserves a careful selection of balanced governance activities (Walch, 2019) to preserve the original libertarian ideal of blockchain technology while supporting the technology's resilience (Bendiek & Neyer, 2020). The design of a technological solution and corresponding governance mechanism may contribute greatly to a healthy balance.

6.4.2 Deducing the significance of a value base

The European Union and its member states rely on digital services, components, and infrastructure in critical social domains, whose development or operations they do not significantly govern (Kar & Thapa, 2020). This situation may easily repeat when blockchain solutions are based on existing public blockchain solutions such as the Bitcoin blockchain with many stakeholders outside the European jurisdiction. As illustrated with the cases of Malta or the city of Zug, countries and other public communities rely on public blockchain scenarios already.

Ongoing debates on how state actors can ensure their sovereignty are not surprising (Adonis, 2019), and efforts of the European Union to set up a European blockchain services infrastructure (Baldacci & Frade, 2021) seem comprehensible in light of this control dilemma leaning toward a private blockchain setting (European Union, 2021). Bendiek and Neyer (2020) point to the diverging motives the European Union may follow, which should not only focus on economics but also aim to maintain the contested European social model.

Private permissioned blockchain settings are sometimes perceived as a suitable approach to support the adoption of blockchain-based solutions (eu-LISA, 2019). This raises the question whether a private (permissioned) blockchain setting could be the answer to digital sovereignty issues. This dissertation argues that a permissioned blockchain setting may support the digital sovereignty of states, but not necessarily other stakeholders' sovereignty rights. A technological solution per se does not guarantee digital sovereignty but the values that drive development, operation respectively governance processes.

Chinese public organizations, for example, also consider implementing a private blockchain scenario referred to as a "Sovereignty blockchain", which assembles an explicit combination of code and legal practices (Yuming, 2021). While the European and Chinese blockchain initiatives both rely on private settings, they differ by the values applied to the entire blockchain ecosystem, including exerted legal practices. This points to the relevance and importance of values in blockchain governance because socials influences apply (Hacker et al., 2019).

Although various research activities concern digital sovereignty (Adonis, 2019), explicit research on values for blockchain governance are scarce (e.g., Zavolokina, Ziolkowski, & Bauer, 2020). Consequently, this dissertation proposes further research on value-based approaches to blockchain governance. Table 14 presents exemplary questions as starting points for research:

Table 14: Potential research questions for value-based blockchain governance

# (cont'd)	Potential questions for further research	Scope
4	How can public administrations enforce their values in blockchain ecosystems?	Value enforcement

# (cont'd)	Potential questions for further research	Scope
5	What governance activities in blockchain development and operations are relevant to implement shared values in multi-stakeholder blockchain ecosystems?	Governance arrangement
6	What is the impact of value-based governance of blockchain on provided public services?	Public service impact
7	What is the impact of value-based blockchain governance for stakeholders?	Stakeholder impact
8	How can blockchain settings be assessed for their value base?	Governance assessment
9	What is the value base of today's blockchain solutions of public administrations?	Empirical research

This research also mirrors criticism of missing democratic values in regulation and enforcement of digital networks (Pohle & Thiel, 2019). If blockchain is adopted by more public administrations and even more stakeholders rely on trustworthy blockchain-based public services, the importance of common values implemented in blockchain ecosystem may also increase the same way. At the same time, the number of blockchain implementations is already increasing. Answers to the above questions may be important for practitioners in politics and public administrations sooner than later.

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APPENDICES

A3.1 Published ICEGOV 2019 Paper

Corresponding article information	
Title	Can Blockchain Leverage for New Public Governance? A Conceptual Analysis on Process Level
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DOI	10.1145/3326365.3326409

Note: The numeration of figures and tables was adjusted to ensure proper identification throughout this dissertation. No changes to content were made in the context of these adjustments.

Abstract

New Public Governance (NPG) as a paradigm for collaborative forms of public service delivery and Blockchain governance are trending topics for researchers and practitioners alike. Thus far, each topic has, on the whole, been discussed separately. This paper presents the preliminary results of ongoing research which aims to shed light on the more concrete benefits of Blockchain for the purpose of NPG. For the first time, a conceptual analysis is conducted on process level to spot benefits and limitations of Blockchain-based governance. Per process element, Blockchain key characteristics are mapped to functional aspects of NPG from a governance perspective. The preliminary results show that Blockchain offers valuable support for governments seeking methods to effectively coordinate co-producing networks. However, the extent of benefits of Blockchain varies across the process elements. It becomes evident that there is a need for off-chain processes. It is, therefore, argued in favor of intensifying research on off-chain governance processes to better understand the implications for and influences on on-chain governance.

1. Introduction

The focus of researchers has partly shifted from an intra-organizational towards an interorganizational working style in the public sector. Collaboration with non-governmental stakeholders is perceived as a political requirement for public administrations (Osborne, 2010a). An efficient governance of collaborating stakeholders is the key for success in this process. The paradigm of New Public Governance (NPG) can be seen as an understanding on how to strategically organize public administrations and shape their role in a co-producing environment from an academic standpoint.

Potentials of ICT for supporting participative governance are discussed theoretically and practically. For example, a vision in which technologies are used to establish organic and leaderless interactions between public and non-public participants is described by Rodriguez Bolivar (Rodríguez Bolívar, 2018). Especially the technological approach of Blockchain (BC) is loaded with high expectations of how it could change the way public administrations work in the future. It is stated BC could allow a large-scale rethinking of political organizations (Reijers, O'Brolcháin, & Haynes, 2016) and could fundamentally change the understanding of effective governance.

Nonetheless, discussions about collaborative public administrations largely fail to keep up with these IT developments (Wewer, 2013). Literature has so far failed to deliver an analysis aiming at a more detailed understanding of the conceptual fit between BC and NPG. Instead, NPG as a paradigm towards inclusive public administrations and BC are discussed separately. Literature on BC governance in the public sector has sought to answer generic questions on this matter. It is, however, important to answer the key questions of governance, i.e. how and where exactly decisions are made (Campbell-Verduyn, 2018b).

Therefore, the aim of this research is to bring together the NPG paradigm and the BC approach and to discuss whether the BC key characteristics could enable the collaborative way of working as described in the NPG paradigm. This article is structured as follows. Sections 2 and 3 present the research background by introducing the paper's core concepts NPG and BC. Key characteristics of BC governance and NPG are derived from literature. Section 4 describes the research design. A generic process, including its single process elements, for public service delivery represents the basis for the analysis. Then, each process element is described with respect to NPG core elements by considering the BC key characteristics. In section 5, the preliminary results are provided and discussed. Afterwards, conclusions are drawn, including an outlook on further work (section 6).

2. New Public Governance

Interest in reforms of public administrations has been increasing among scientists, especially with respect to their fundamental understanding and interdependencies with other public stakeholders (van de Walle & Groeneveld, 2016). Civil society and private institutions are raising new demands. For example, demography and individualization are growing in importance and citizens are demanding increased participation and autonomy (Schedler & Proeller, 2011). Additionally, public administrations are facing trust issues from the public. And finally, companies expect support from public administrations to overcome challenges of e.g. globalization and liberalization (Schedler & Proeller, 2011). Politicians nowadays, therefore, often demand openness and a greater flexibility on the part of public administrations (Schedler & Proeller, 2011). It is argued that this would require an increasing degree of cooperation. This corresponds to a shift towards a governance perspective, when public services are not created by public administrations alone but are rather a result of co-production between those public administrations and other stakeholders (Abeysekera, 2015; Osborne, 2010a; Pestoff, Brandsen, & Verschuere, 2012; Torfing & Triantafillou, 2016b). That scientific shift towards the governance of complex interorganizational relationships to create public services is well documented in the literature of recent years (Torfing & Triantafillou, 2016b; Wiesel & Modell, 2014).

The governance-focused paradigm aims at formal and informal processes within which stakeholders interact in order to create public services. Borders between stakeholders and public administrations would then be considered increasingly fluent (Osborne, 2010a; Rodríguez Bolívar, 2018). That strong emphasis on governance for the sake of creating more efficient public services by combining stakeholder capacities is understood as New Public Governance (NPG). For an effective governance, NPG favors a “more integrative leadership and trust-based management.” (Torfing & Triantafillou, 2016b, p. 13) The new focus on interorganizational governance is mostly new to European countries as they were focusing on inner-institutional topics coming from New Public Management. This intra-organizational view does not become obsolete. With NPG both views can be holistically incorporated (Osborne, 2010a; Torfing & Triantafillou, 2016b; Vries, 2010).

NPG relies on multiple concepts of governance, such as network governance and social-political governance. For this present paper, however, the most essential underlying concept of governance within NPG is collaborative governance as it “synergistically brings together knowledge, resources, skills and perspectives to deliver improved public services and public goods.” (Ansell, 2016, p. 36)

Applying NPG implies drastic changes to the roles of people traditionally involved in public service processes. Today’s public services consumers instantaneously become service designers, co-producers and evaluators of those service experiences (Torfing & Triantafillou, 2016b). And public administrations become “only one player amongst many others” (Kennett, 2010, p. 20) which primarily focus on the coordination of co-producing networks (Wiesel & Modell, 2014). Technological support is not new to NPG practitioners striving for co-produced public services. However, technologies have so far been seen rather as instruments to support and electronically implement more or less isolated process steps by e-government applications (Pestoff et al., 2012). It is difficult to instigate meaningful institutional changes via this concept.

In summary, the following core elements of NPG can be described, see also (Osborne, 2010a):

- Voluntary co-producing networks (value base: neo-corporatist)

- Inter-organizational governance
- Relational contracts or trust-based management

3. Blockchain

BC is not only one of the most trending topics in IT research but also for corresponding practitioners. Although scholars still focus strongly on cryptocurrencies (Yli-Huumo et al., 2016), there is much more that BC has to offer. BC allows a secure transfer of any kind of digital value (e.g. intellectual property rights, contracts).

BC itself is not a technology, rather it is a realization of combined technologies (Campbell-Verduyn, 2018b). Generally speaking, BC is a trustworthy electronic, distributed ledger in which transaction data is securely stored within a network of participating nodes (Yli-Huumo et al., 2016). This decentralized ledger is transparent to every node. BC's plus point is its resistance to manipulations (Yli-Huumo et al., 2016). Consensus mechanisms are used to validate transactions before they are stored as blocks and added to the ledger (Campbell-Verduyn, 2018b).

Whether one is allowed to access the BC network depends on the individual setup. Public BCs can be viewed by anyone, whereas access to private BCs is restricted to selected users. The setup also decides on user privileges, i.e. whether they are permitted to write or read only on a BC. Design choices and the BC governance influence the potential benefits of BC applications (Ølnes et al., 2017). BC governance is based on the well-known IT governance dimensions (decision rights, accountability and incentives) (Beck, Müller-Bloch, & King, 2018; Beutel, 2018; Campbell-Verduyn, 2018b). "Decision rights concern the rights governing control over certain assets," (Beck et al., 2018, p. 10) whereas accountability focuses on monitoring and enforcing decisions. Incentives ensure proper motivation of involved actors (Beck et al., 2018).

The decentralized concept of BC is a key argument for scholars to think about whether public administrations as intermediates between citizens or companies may become obsolete (Atzori, 2015; Campbell-Verduyn, 2018b; Davidson et al., 2016a). The use of pre-defined code and automatic code execution may reinvent public service delivery (Atzori, 2015; Seebacher & Schüritz, 2017). However, it is fairly unlikely that public administrations can be eliminated entirely. Those administrations are not merely providers of public services but also authorities which balance powers and ensure welfare and equality. Subsequently, and in accordance to the fundamentals of NPG, this paper assumes that public administrations will remain and BC could contribute to their necessary reforms as pointed out before.

As with any other technological solution, all characteristics and advantages related to the term "BC" will have to be elaborated upon to serve the promised purpose for citizens, business or public administrations (Ølnes et al., 2017). The review of known BC implementations demonstrates that this conglomerate of characteristics, forming the uniqueness of BC, does not apply for every use case. Furthermore, the existing technological landscapes make it harder and potentially more expensive to replace old technological structures. Public administrations in Europe, therefore, often start small in order to learn from their first experiences.

In summary, BC offers the key advantage of data integrity (immutability) based on decentralization, paired with consensus mechanisms and transparency. The following design options determine the concrete use in the public sector and concern the governance by BC:

- Decision rights
- Accountability
- Incentives

4. Methodological approach

The aim of the research presented here is to find out whether and to what extent a BC-based public service system contributes to the fundamentals of NPG. The analysis is based on a generic service delivery process, consisting of the process elements Strategy, Design, Implementation and Monitoring/Evaluation, as NPG emphasizes service processes and outcomes.

With the first step, functional governance requirements from NPG perspective are derived on process element level. To do so, governance-related core activities for each process element are gathered from a literature review. The identified core activities are then assigned the relevant NPG core element and governance characteristic. This leads to a matrix of categorized core activities per process element (Step 2). Due to the defined process-related structure and therein identified governance-related core activities, it is then easier to depict the implications on governance enabled by BC's key characteristics in the light of NPG. By doing so, the BC key characteristics support the governance-related analysis and represent the link between the functional core elements of NPG and the technical ones of BC (Step 3). The analysis results in statements where the technology of BC covers the functional requirements of NPG and where it may offer no proper solutions.

As a result, a classification system can be derived which represents an aggregated view on the analysis outcomes from the overall service process perspective (see fig. 1 in section 5). Also, it serves to categorize and strategically orient concrete solutions in practice. Furthermore, it acts as a basis for a research framework. In addition, this approach provides a clear picture for which process elements BC covers the functional requirements of NPG and to understand the limitations of BC-enabled governance. In the same way, it is also possible to determine what potentials BC-enabled governance can offer to NPG.

5. Preliminary results and discussion

When comparing the core elements of NPG and the characteristics of BC, it becomes clear that the technological concept BC and the reform paradigm NPG have obvious similarities. The classification system attempts to systematically represent these matches. However, this is a preliminary result that needs to be confirmed or adjusted on the basis of empirical studies. Figure 7 shows the classification system that integrates the core elements of NPG and BC and depicts the aggregated conceptual fit on a generic level. The decision as to whether a match is rather high or low is based on the conceptual overlaps and links (e.g., NPG networks are based on decentralization, hence high correspondence). It should be noted that dependencies exist between the BC characteristics and the BC governance dimensions, which are not considered here. For the further development of the classification systems, these relationships should also be examined and described.

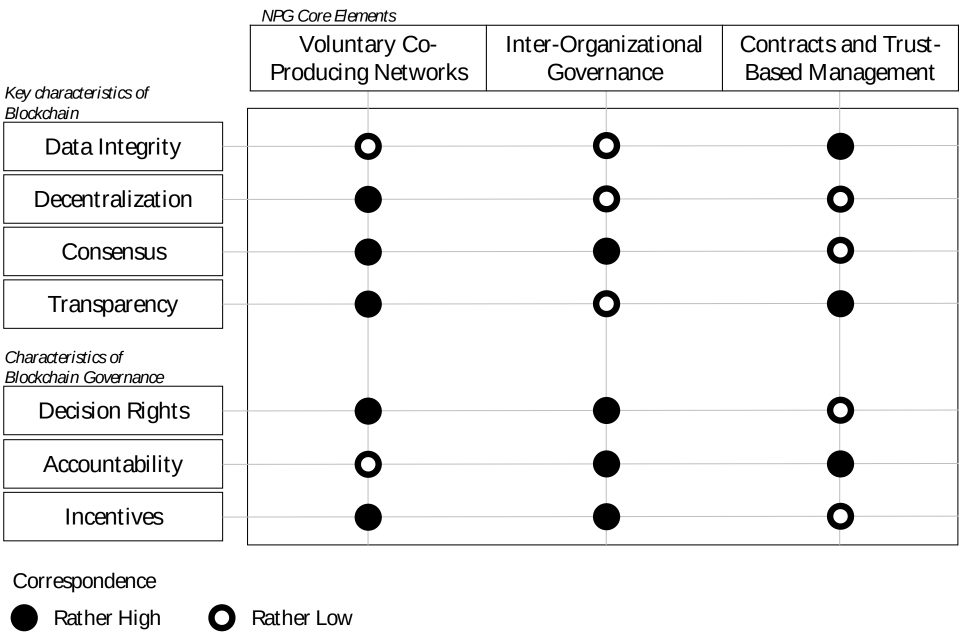


Figure 7: Classification System for BC Usage within NPG

Considering the breakdown into process elements, the following key findings so far are presented for each process element.

First, within the Strategy element rather intense governmental coordination is required because the strategy not only determines strategic service aspects (e.g. what service is in scope) but also defines fundamentals of the BC setup, such as the decision on the to be used protocol or consensus mechanism. Despite that, it is noticed that BC is able to cover most steps of strategy definition: it allows the coordination of a service strategy process as it provides mechanisms for proposal handling (Seebacher & Schüritz, 2017), organized exchange between various actors and voting. However, intense negotiations which are common within each strategy process cannot be covered by BC (Atzori, 2015) because negotiations do not always follow formal procedures. Also, opportunistic behavior can hardly be recognized by BC algorithms.

Second, regarding the Design element it becomes clear that co-production in its full extent is technically not possible, i.e. a simultaneous design and consumption (meaning here "implementation") of a service (Pestoff et al., 2012) cannot be achieved because BC requires per definition pre-defined rules in code (Seebacher & Schüritz, 2017) in order to be executed. Nonetheless, BC offers the opportunity to instigate smart contracts for the creation of customized services. But similar to the Strategy element, intensive negotiations or discussions on the design of service processes might need to be handled off-chain.

Third, the Implementation element clearly shows that executing pre-defined rules is a core strength of BC. Smart contracts can be leveraged either locally or globally to ensure rights and duties of citizens, business or the government. Direct state involvement is not obligatory either. Although single services might be designed in isolation from one another, a service can offer indirect links for the coordination of another (Davidson et al., 2016a). However, a key consideration for NPG is that co-production is voluntary for citizens and business (Pestoff et al., 2012). It is questionable whether this is valid for BC-based service systems because everything is coded upfront.

And fourth, public service agents can easily gather data from the BC for the purpose of monitoring and evaluation (Davidson et al., 2016a). Pre-defined rules can make sure that required data is available to the public service agent (Seebacher & Schüritz, 2017) and help him/her to evaluate results and understand whether expected process outcomes have been met.

In summary, it becomes evident that the more formal the activities, the stronger BC's ability to support coordinating or co-producing actors. Consequently, BC is stronger in the area of implementation and monitoring/evaluation of services, and weaker when it comes to conceptual activities within strategy and design. Especially within the latter elements, off-chain processes will need to be considered and defined, which should be the responsibility of the governmental coordinator.

6. Conclusions

This paper presents the status quo of ongoing research activities. The analysis of the conceptual match between NPG and BC-based governance has been realized. Going forward, it has to be shown if this theoretical match still holds true when considering empirical studies or social science theories, such as the social contract theory. Opportunistic behavior influencing the development and use of BC-based services is an example that demonstrates the influence of social matters resting outside the BC sphere.

Also, this paper presents the BC's ability to enable functional characteristics required for NPG. Next, it should be critically assessed if BC – when applied with all its potentials – can advance NPG. For instance, human interaction (e.g. public service agents) plays a significant role following the NPG paradigm. BC may offer solutions that mean a shift from human to technological accountability.

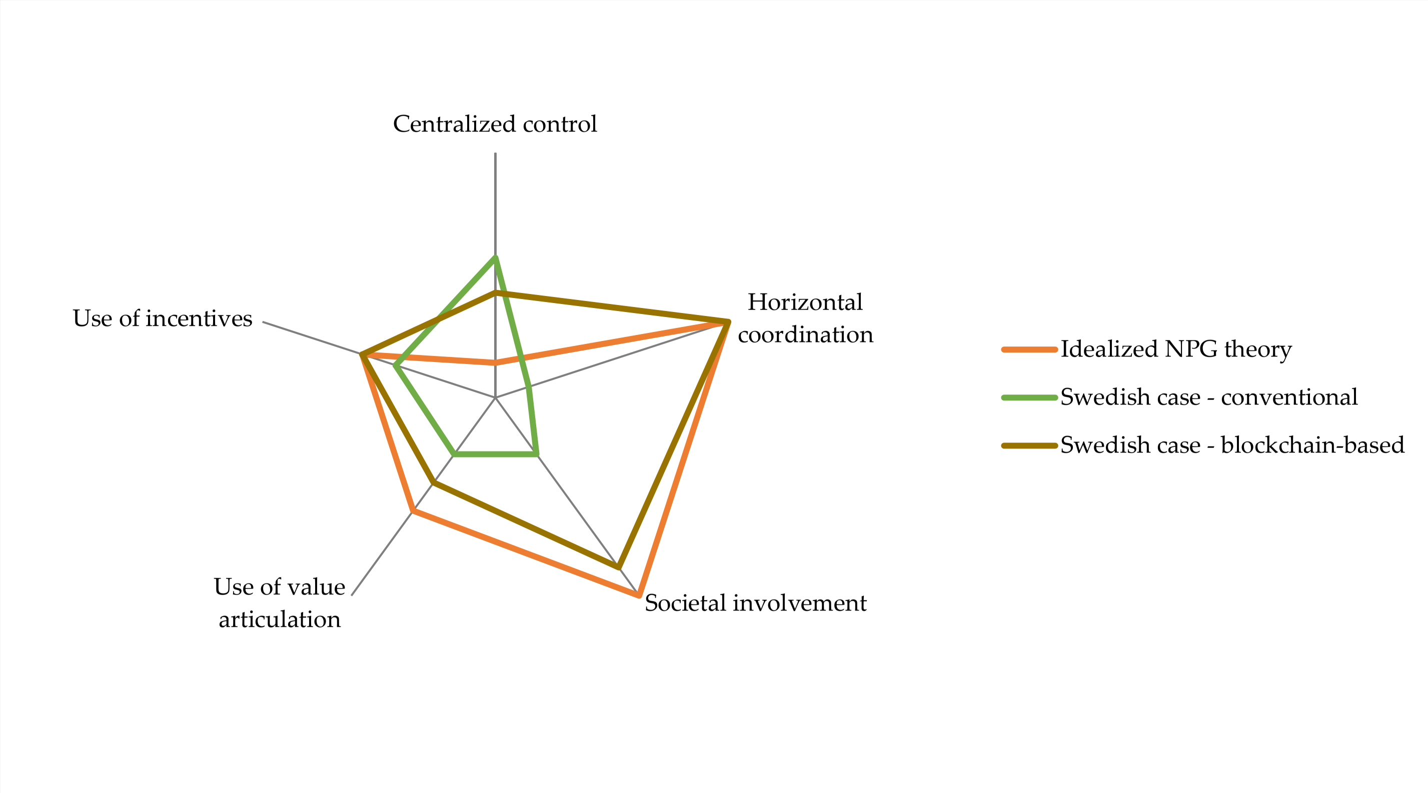
In general, governance by BC may become the most important research area to realize sustainable BC solutions for the public sector. When trust in data is no longer the issue, it is worth considering whether trust in governance in a BC environment is a new "trust challenge".

A3.2 Comparison and rating of NPG theory and empirical cases

Comparison / Diamond

Case	Idealized NPG theory	Swedish case - conventional	Swedish case - blockchain-based
Dimension	Rating	Rating	Rating
Centralized control	1	4	3
Horizontal coordination	7	1	7
Societal involvement	7	2	6
Use of value articulation	4	2	3
Use of incentives	4	3	4

Scale: 1 - very low; 2 - low; 3 - low to medium; 4 - medium; 5 - medium to high; 6 - high; 7 - very high


Centralized control
Horizontal coordination
Societal involvement
Use of value articulation
Use of incentives
Idealized NPG theory
Swedish case - conventional
Swedish case - blockchain-based

Rating – idealized NPG theory

Case	Idealized NPG theory	
Dimension	Rating	Reasoning [source]
Centralized control	1	- NPG emphasizes a shift towards "horizontal interaction in [rather self-governing] networks" and partnerships [1] for collaboratively and jointly designing and delivering public services and outcomes [1, 5, 6, 9] - NPG pictures public administrations in a role of coordinating social interests, dialog among actors and integrating public resources [16]
Horizontal coordination	7	- NPG "strongly recommends horizontal coordination in cross-boundary networks" [1, also 6, 9, 12] - It thereby aims to eliminate bureaucratic silos and "fragmented steering landscapes" [1] in order to solve complex problems [1, 4, 5, 6] - Collaboration among interdependent public and non-public actors is preferred for joint problem-solving [4, 9, 14]
Societal involvement	7	- The concept of NPG prefers the inclusion of a wide range of societal actors (e.g. public administrations, citizens, private firms) within networks and partnerships [1, 3, 4, 9, 12, 15]

Case	Idealized NPG theory	
Dimension	Rating	Reasoning [source]
		- Actors are involved in relation to their affectedness and the required competencies [3] to jointly solve wicked problems and produce "innovative, effective and democratic outcomes" [1]
Use of value articulation	4	- "NPG acknowledges the role of public values in networks and in governance more generally, but the use of value articulation is less central to [other governance paradigms]" [1] - "Participation in interactive governance processes is motivated by the mutual dependency of the social and political [actors]." [1, also 15] - Common values may motivate to collaborate with each other [1]. These values could stem from striving for solutions to environmental, political [1], economic or social issues [2, 16] - However, it can be difficult to align network actors' values when they come from organizations with different value sets and diverging interests [1, 2, 7, 9] - "Co-production requires trust" [14]
Use of incentives	4	- "Both interdependency theory and governability theory refer to the use of incentives to encourage networking and solve collective actions problems. Incentives can render participation in and contributions by joint solutions in networks more appealing than solutions obtained by going it alone." [1]

Case	Idealized NPG theory	
Dimension	Rating	Reasoning [source]
		- "Positive and negative incentives are generally seen as playing a marginal role in governance processes." [1] - "Relations between the actors involved in public governance are supposed to be based on mutual trust and the constructive management of differences" [1] and are supposed to present e.g. win-win-situations and other advantages of working together [7, 13, 14]. - Interactions in cross-boundary networks should "be based on interdependency rather than competition"[1] but "tense bargaining can itself create incentives for a shift to a problem-solving orientation" [7]

Scale: 1 - very low; 2 - low; 3 - low to medium; 4 - medium; 5 - medium to high; 6 - high; 7 - very high

Sources [n]	
1	Torfing, J., Bøgh Andersen, L., & Greve, C. (2020). Public Governance Paradigms: Competing and Co-Existing. Policy, Administrative and Institutional Change Ser. Cheltenham, Gloucestershire: Edward Elgar Publishing Limited.

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6	Osborne, S. P., & Radnor, Z. (2016). The New Public Governance and Innovation in Public Services: A Public Service-Dominant Approach. In J. Torfing & P. Triantafillou (Eds.), Enhancing Public Innovation by Transforming Public Governance (pp. 54–70). Cambridge: Cambridge University Press.

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7	Ansell, C. K. (2016). Collaborative Governance as Creative Problem-Solving. In J. Torfing & P. Triantafillou (Eds.), Enhancing Public Innovation by Transforming Public Governance (pp. 35–53). Cambridge: Cambridge University Press.
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11	Osborne, S. P. (2010). Public governance and public services delivery: A research agenda for the future. In S. P. Osborne (Ed.), The new public governance: Emerging perspectives on the theory and practice of public governance (pp. 413–428). London, New York: Routledge.

Sources [n]	
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14	Loeffler, E., & Bovaird, T. (2018). From Participation to Co-production: Widening and Deepening the Contributions of Citizens to Public Services and Outcomes. In E. Ongaro & S. van Thiel (Eds.), The Palgrave Handbook of Public Administration and Management in Europe (pp. 403–424). London: Palgrave Macmillan UK.
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Rating - conventional case

Case	Conventional use case	
Dimension	Rating	Reasoning [source]
Centralized control	4	- Public or non-public actors are not in control of entire value chain, only offering process interfaces to their own domain where control can be naturally high - But major governance decisions regarding public service delivery are made by public administration - The paradigmatic slogan "led leaders lead" of NPM [3] may not apply for the conventional use case because the scope of the public administration is quite narrow after all
Horizontal coordination	1	- "Lantmäteriet is only involved in a few steps at the end of the real estate transactions. As a consequence of this the majority of the process is not transparent, in other words, visible to the public or other stakeholders." [1] - The disintegrated setup of working has "resulted in sellers, buyers, banks and real estate agents being forced to create their own complex processes for agreements, since they have to make sure that things can't go wrong, and because the value of the transactions is large. This creates ineffciency." [1]

Case	Conventional use case	
Dimension	Rating	Reasoning [source]
		- A third problem is to secure the process. "The most discussed example of such a process is trade finance, where a sequence of actors [have to take responsibility and] confirm what they are doing at various stages in the agreement." [1] - Horizontal interactions to jointly deliver the public administration's core public services could not be identified.
Societal involvement	2	- Lantmäteriet already participates in collaboration projects with other actors, i.e. authorities, municipalities and companies [4] - Existing collaboration projects involve participations in e.g., councils, the provision of geodata or jointly working on national specifications for information exchange [4]. Also, a regular feedback process for citizens seems to be implemented [2]. - "Overall" process is rather considered by individual actors and within their boundaries
Use of value articulation	2	- Normative interorganizational appeals could not be identified - Occasional alignment on values and purposes among public and non-public actors can be assumed as part of ongoing collaboration projects

Case	Conventional use case	
Dimension	Rating	Reasoning [source]
Use of incentives	3	- Strong obligations for non-public actions by law, e.g. stampy duty, service charges need to be paid to public authority, or registration in the land registry [1] - Official confirmation of ownership by public authority [1]

Scale: 1 - very low; 2 - low; 3 - low to medium; 4 - medium; 5 - medium to high; 6 - high; 7 - very high

Sources [n]	
1	Kairos Future (2017). The Land Registry in the blockchain - testbed: A development project with Lantmäteriet, Landshypotek Bank, SBAB, Telia company, ChromaWay and Kairos Future.
2	Lantmateriet (2021). Contact us. https://www.lantmateriet.se/en/about-lantmateriet/kontakta-oss/hjalp-oss-att-bli-battre/
3	Torfing, J., Bøgh Andersen, L., & Greve, C. (2020). Public Governance Paradigms: Competing and Co-Existing. Policy, Administrative and Institutional Change Ser. Cheltenham, Gloucestershire: Edward Elgar Publishing Limited.
4	Lantmateriet (2021). About Lantmateriet. https://www.lantmateriet.se/zh-tw/about-lantmateriet/Samverkan-med-andra/

Rating – blockchain-based case

Case	Blockchain-based use case	
Dimension	Rating	Reasoning [source]
Centralized control	3	- Blockchain solution increases the ability of participating actors to make their own decisions along the process. - "Greater security for users of the system, in part because validation of the purchasing contracts and ownership can be done independently from Lantmäteriet" [1], i.e. non-public actors can act more independently from public actors within the public service process. - However, they are bound to the obligatory system/process which is predefined by only a few making key governance decisions. [4, 5] - There is increased technical control by a few players due to private blockchain setting.
Horizontal coordination	7	- Blockchain solution integrates formerly isolated process steps. Interorganizational networking is realized facilitated by one platform for the overall process. - The blockchain solution secured the publice service delivery [1]. - More efficient collaboration due to immediate data access [1].

Case	Blockchain-based use case	
Dimension	Rating	Reasoning [source]
		- Actor involvement arranged differently, e.g. because of earlier involvement of public administration or obsolet confirmation activities - Non-public actors (i.e. seller) can take over new tasks /shift of tasks [1].
Societal involvement	6	- Number of actors remains the same on functional level but act in a more integrated way. - New responsibilities/tasks for non-public actors implemented. - Increased number of actors with respect to technical governance. Joint alignment on further developments. - As seen with this use case, there is alignment on governance required with non-public actors to build and maintain a solution that reflects needs of non-public actors. - But public administration is not willing share every aspect of governance [3].
Use of value articulation	3	- Blockchain solution may "provide a value similar to informal institutions and create a positive dynamic within an economy." [1]

Case	Blockchain-based use case	
Dimension	Rating	Reasoning [source]
		- (Constant) alignment on goals and purposes necessary to (further) develop the system and process due to interdepencies when jointly running the system. - Actors are driven by values related to efficieny, effectiveness and transparency [5], but data suggests values are not used as a "primary driver" [1, 5]
Use of incentives	4	- Multiple positive incentives because of joint public service delivery: "Faster and more transparent transactions", "eliminating the need for physical archives of contracts and files" or "significantly improved mortgage deed handling, and making payments of loans dependent on secure transfer of mortgage deed" [1, also 5] - Also, efficiency incentives are perceived as relevant: "Today, agents, buyers and sellers can be sitting for two hours signing several hundred pages of documents when signing a purchasing contract, since all of the documents and often all of the pages in several documents need a signature or initials written by hand" [1] - Collaboration aspect may be seen as a driver for motivation/commitment ("my solution/ my process")

Case	Blockchain-based use case	
Dimension	Rating	Reasoning [source]
		- If new process becomes mandatory by law, it would affect more parts of non-public actors/organizations since the solution then encompasses more process elements compared to conventional use case

Scale: 1 - very low; 2 - low; 3 - low to medium; 4 - medium; 5 - medium to high; 6 - high; 7 - very high

Sources [n]

1 Kairos Future (2017). The Land Registry in the blockchain - testbed: A development project with Lantmäteriet, Landshypotek Bank, SBAB, Telia company, ChromaWay and Kairos Future.

2 Torfing, J., Bøgh Andersen, L., & Greve, C. (2020). Public Governance Paradigms: Competing and Co-Existing. Policy, Administrative and Institutional Change Ser. Cheltenham, Gloucestershire: Edward Elgar Publishing Limited.

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Sources [n]
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A3.3 Questionnaire for Delphi study

(Translated from German)

No	Question	Idealist NPG theory	Target dimension	Provided clarification of terms
1	Should a public service be blockchain-based and implemented across stakeholders: to what extent is a public administration needed in a coordinating role?	Answer selection	Centralized control	"across stakeholders" refers to the interaction between multiple stakeholders, e.g., public administration <-> company, citizen <-> company, citizen <-> public administration, public administration <-> public administration
2	Please give reasons for your answer.	Free text	Centralized control	/
3	If a public service is understood as a process: can a cross-actor public service be implemented completely blockchain-based?	Answer selection	Horizontal coordination	/

No	Question	Idealist NPG theory	Target dimension	Provided clarification of terms
4	If the public service cannot be implemented completely blockchain-based: which process elements, if any, could remain with an actor?	Free text	Horizontal coordination	"process elements" can be especially organizational or technical in nature.
5	If multiple actors are to be involved in the design of a public service: is the formulation of shared values necessary for the design of a cross-actor blockchain-based public service?	Answer selection	Use of value articulation	"Values" are regarded here as a question of inner attitude and motivation. These can be, for example, the sense of justice, the need for security or the desire for self-determination.
6	In your view, what POSITIVE incentives for users could be effective in ensuring the use of a cross-actor, blockchain-based public service?	Free text	Use of incentives	"Incentives" are considered to be external stimulation to motivate a desired action or behavior. Positive incentives in this sense can be tax relief, for example.
	In your view, what NEGATIVE incentives for users could be effective in	Free text	Use of incentives	"Incentives" are considered to be external stimulation to motivate a

No	Question	Idealist NPG theory	Target dimension	Provided clarification of terms
	ensuring the use of a cross-actor, blockchain-based public service?			desired action or behavior. A negative incentive in this sense can be, for example, legal coercion.
7	What is the relevance of blockchain governance of a blockchain-based public service to user acceptance of the overall public service? (users are e.g. citizens or companies).	5-Point Likert-Scale	Societal involvement	- Users" are e.g. citizens or economic operators. - "Governance" refers esp. to control, regulation and structure of the technical blockchain solution (e.g. setup as a public or private blockchain, selection of the consensus algorithm)
8	Please give reasons for your answer.	Free text	Societal involvement	/
9	What impact might the use of a consortium blockchain have on adoption by public service users?	5-Point Likert-Scale	Centralized control	- Users" are e.g. citizens or economic operators. - "In a consortium blockchain, the consensus process is controlled by a pre-

No	Question	Idealist NPG theory	Target dimension	Provided clarification of terms
				determined group.... The right to read the blockchain and execute transactions can be granted to anyone or only to participants." (SAP, 2021)
10	Please give reasons for your answer.	Free text	Centralized control	

A3.4 Data analysis of Delphi study

Questions 1/2: “Should a public service be blockchain-based and implemented across stakeholders: to what extent is a public administration needed in a coordinating role?”

Frage-Scope	Challenge the degree of De-centralization/ self-organization - How much decentralization is needed despite the shift towards horizontal coordiniation? - Is coordinating role important for/because of/despite BC?
Fragetyp	Freitext
Beschreibung	Bitte begründen Sie Ihre Antwort im Meinungsfeld. Begriffsklärung: "akteursübergreifend" bezieht sich auf die Interaktion zwischen mehreren Akteuren, wie z. B. Behörde <-> Unternehmen, Bürger*in <-> Unternehmen, Bürger*in <-> Behörde, Behörde <-> Behörde
Anzahl der Teilnehmer (n)	19
Übergreifende Analyse	- Große Zustimmung - Leistungsabhängig - Koordinationsrolle ist zu klären (Was heißt Koordination [=Kontrolle]? Was und wann soll koordiniert werden?) - Gründe für Koordination: Vertrauensinstanz, Existenzberechtigung - Wurde Koordinationsbegriff von allen Teilnehmern verstanden?

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 110	IT Sol. Prov.	Das hängt davon ab, um welche Verwaltungsleistung es geht. Die Blockchain-Technologie ist nicht das allein seelig machende Mittel zum Zweck. Dort wo mehrere Akteure miteinander interagieren und eine zentrale Lösung nicht in Frage kommt oder mit erheblichen Risiken verbunden (single point of attack), halte ich es für sinnvoll, über Blockchain nachzudenken. Ob eine öffentliche Verwaltung in koordinierender Form gebraucht wird, hängt ebenfalls vom Kontext ab.	- teilweise Zustimmung- Koordinationsrolle abhängig von Leistung --> nicht pauschal denkbar; - bei Interaktion von mehreren Akteuren und risikobehaftet
Anonym 35	IT Sol. Prov.	Das kommt darauf an, was für eine Art von Verwaltungsleistung es ist, inwiefern hier G2G-Kommunikation notwendig ist und ob technische oder rechtliche Koordinierung gemeint ist. Eine koordinierende Funktion der Verwaltung ist zumindest immer dort bzw. ab dem Zeitpunkt notwendig, wo auf sensible Verwaltungsdaten zugegriffen, hoheitliche Tätigkeiten durchgeführt oder aber sensible Daten im Rahmen des Aufgabengebietes verarbeitet werden.	- teilweise Zustimmung - Koordinationsrolle abhängig von Leistung und Koordinations-Scope (technisch/rechtlich) --> nicht pauschal denkbar; - Koord.-Funktion für sensible Daten, hoheitliche Tätigkeiten
Anonym 72	IT Sol. Prov.	Das ist eine sehr allgemeine Fragestellung. Eine blockchain-basierte Lösung sollte dann in Betracht gezogen werden, wenn eine zentralisierte Lösung die geforderte Funktionalität aus diversen Gründen (technisch, organisatorisch, rechtlich, strategisch, politisch) nicht bereitstellen kann. Konkretes Beispiel wäre z.B. das Identity-Management, wird heute online von Facebook, Google	- Grundsatz: Dezentrale Lösung, wenn zentrale Lösung nicht geeignet

Teilnehmer	Berufsgruppe	Antwort	Analyse
		usw. übernommen. Blockchain könnte auch innerhalb eines föderalen Systems eine Lösung in DE sein.	
Anonym 100	IT Sol. Prov.	Aus meiner Sicht wäre die öffentliche Verwaltung nicht nur in koordinierender Funktion, sondern auch als „Vertrauensgeber“ innerhalb einer „private Blockchain“ erforderlich. Ich habe Zweifel, ob eine Blockchain-basierte Verwaltungsleistung ohne diese Instanz angenommen und akzeptiert würde. Hinzu kommt, dass die benötigte Rechenleistung (Klimaschutz) in einer solchen Lösung geringer wäre.	- Zustimmung - Nicht nur koordinierend, sondern auch vertrauensgebend - ohne Verwaltung, Zweifel an Akzeptanz - Private Blockchain braucht weniger Rechenleistung (Klimaschutz)
Anonym 144	IT Sol. Prov.	Ja, auf jeden Fall. Meiner Meinung kann die Blockchain gerade bei Behördenübergreifenden Prozesse die Arbeit entlasten, beschleunigen und gleichzeitig die Qualität durch Smart--Contracts gewährleisten. Die öffentliche Verwaltung koordiniert und verwaltet die Smart-Contracts bzw. die darin abgebildete Prozesse	- Zustimmung - Koordination von Smart Contracts und Prozessen
Anonym 64	IT Sol. Prov.	Ja, wenn sinnvoll. Dies gilt aus meiner Sicht für Anwendungsbereiche, in denen die Verifizierung durch eine Behörde benötigt oder durch diese die Rahmenbedingungen definiert werden. Dies kann etwa für notarielle Beglaubigungen, Geburtsurkunden und ähnliche Dokumente sowie hoheitliche Aufgaben, wie Zoll und Steuern, sinnvoll sein. Die Behörde	- teilweise Zustimmung - abhängig von Leistung - Koordination: Verifikation oder Definition von Rahmenbedingungen oder Überwachung

Teilnehmer	Berufsgruppe	Antwort	Analyse
		könnte aber auch lediglich Lesezugriff erhalten, etwa bei der Überwachung von Handelsketten.	
Anonym 10	IT Sol. Prov.	Für die iterative Fortentwicklung des rechtlichen Rahmens insbesondere in Moderation verschiedener Stakeholder, für die Einbettung in ein gesellschaftlich gewolltes Zielbild sowie für die kontinuierliche Anpassung an weitere technologische Entwicklungen und Rahmenbedingungen als Vertrauens-, Kommunikations- und Transparenzinstanz in der Öffentlichkeit, welche die Mechanismen und Wirkdimensionen interessensneutral artikulieren kann und systematische Alternativen moderieren kann	- Zustimmung - Fortentwicklung Rechtsrahmen - Moderation zwischen Stakeholdern - Für Einbettung in gesellschaftlich gewolltes Zielbild <-- also auch inhaltliche Koordination/Steuerung?! - Interessensneutrale Instanz
Anonym 19	IT Sol. Prov.	Koordination durch öffentliche Verwaltung ist vor allem während der Konzeptions- und Einführungsphasen essentiell. Das Versprechen von Blockchain ist die Automatisierung von Kooperation durch klar formulierte Regeln, die im Anschluss "in Code gegossen" werden. Daher ist es essentiell, zu Beginn Regeln aufzustellen, die für alle Beteiligten akzeptabel sind und sinnvolle Prozesse widerspiegeln. Im Anschluss kann sich die Verwaltung mehr und mehr zurückziehen.	- Zustimmung - Koordination während Konzeption und Einführung - Für Moderation zur Erstellung von gemeinsamen Regeln für alle Beteiligte

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 57	Public Admin.	Eine Verwaltungsleistung muss koordiniert werden, sie kann sich meines Erachtens nicht selbstständig verwaltet werden. Die Verwaltung könnte weiterhelfen, weil ihr vertraut wird.	- Zustimmung - Verwaltung als Vertraunsinstanz
Anonym 5	Public Admin.	Dies Frage kann nicht pauschal beantwortet werden. Verwaltungsleitungen sollten nur da blockchain-basiert umgesetzt werden, wo es Sinn macht. Ich halte es für falsch, zu viel Zeit und Energie auf blockchain-basierten Anwendungen aufzuwenden, wenn es eine schnellere und weniger komplizierte Umsetzung gibt. Wichtig ist, dass das Momentum, das uns Covid 19 gebracht hat, genutzt wird, um die Behörden digital fit zu machen. Koordinierende Funktion, ja, wenn Verwaltung nicht ausbremst.	- Grundsatz: Blockchain nur, wenn es sich lohnt
Anonym 127	Public Admin.	Letztenendes widersproicht es eigentlichd er Philosophie der Blockchain, wenn es doch eine "führende" Stelle gibt. Jedoch wird es sich im Kontext des Verwaltungshandelns nicht anders rechtfertigen lassen, der Staat möchte sich ja nicht selbst auflösen. Also die Verwaltung muss behördenübergreifend gemeinsam veramtwortlich sein, wenn blockchain-basiert gearbeitet wird.	- Grundsatz: Koordination als Widerspruch zur Blockchain-Philosophie - Koordinationsrolle als Existenzberechtigung für Verwaltung
Anonym 101	Public Admin.	Blockchain-basierte Verwaltungsleistungen sollten möglichst auf einer Blockchain betrieben werden, die auch von der Verwaltung betrieben wird. Unter der in der Fragestellung angegebenen „koordinierende Funktion“	- Zustimmung - Blockchain-Betrieb durch Verwaltung

Teilnehmer	Berufsgruppe	Antwort	Analyse
		verstehe ich ein Governance-Modell, das für eine BC unbedingt notwendig ist. Konsens-Mechanismen, Schreibrechte, …	- Koordination als Governance-Modell
Anonym 15	Public Admin.	blockchain-basierte Dienstleistungen ergeben dort Sinn, wo amtliche Basisdaten (persönliche EWO-Daten, Führungszeugnisse etc.) Grundlage für Verwaltungsentscheidungen sind, derzeit aber noch über eigene Beantragungswege Ressourcen bei öffentlicher Hand wie auch bei Bürger:innen binden. Aus Gründen der Akzeptanz und der Vertrauensbildung sollte die Blockchain-Infrastruktur unter "staatlicher" Kontrolle stehen.	- Zustimmung - Blockchain-Betrieb durch Verwaltung wegen Akzeptanz und Vertrauensbildung
Anonym 33	Public Admin.	Eine Blockchain ist zunächst einmal nur eine Struktur, um Daten zu speichern, die gewisse Eigenschaften mit sich bringt, wie z. B. der verteilten Speicherung ohne zentrale Steuerung (Dezentralität) und der Tatsache, dass sie nur Ergänzungen, nicht aber Modifikationen wie z. B. Löschungen unterstützt. Somit ist der Einsatz einer Blockchain per se akteursübergreifend. Wie und was die ö. V. koordiniert, hängt nicht mit der Datenstruktur zusammen, sondern mit der Leistung.	- Teilweise Zustimmung - Leistungsabhängig
Anonym 27	Research	Manche benötigten Funktionalitäten innerhalb einer Verwaltungsleistung sind dezentral gut abbildbar, andere Funktionalitäten sind mit weniger Aufwand und/oder zuverlässiger zentralisiert abzubilden. Zum Beispiel ist es so dass Transaktionen öffentlicher Verwaltungsleistungen idr. auf Gesetzen	- Grundsatz: Blockchain nur, wenn es sich lohnt

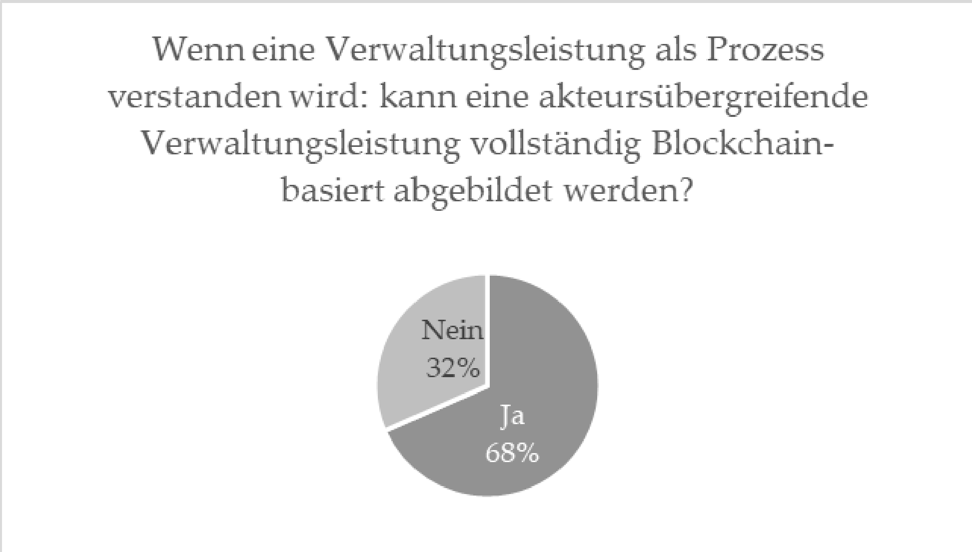
Teilnehmer	Berufsgruppe	Antwort	Analyse
		und Verordnungen basieren. Die Prüfung, inwiefern ein Prozess oder eine Einzeltransaktion Gesetzeskonform ist, lässt sich mitunter zentral besser und zuverlässiger abbilden.	
Anonym 50	Research	Ja, solche Leistungen sollten dringend von behördlicher Seite ausgelotet werden. Die hoheitlichen Funktionen der Verwaltung sollten als solche vorhanden bleiben. Jedoch besteht keine Notwendigkeit, Prozesse langsam und analog abzubilden. Zusätzlich lässt sich über Blockchain- geschützte Prozesse besser entscheiden, wer wann wo welche Daten einsehen und bearbeiten darf - und wer nicht.	- Zustimmung - Bewahrung von hoheitlichen Funktionen/ Verantwortlichkeiten
Anonym 30	Research	Die öffentliche Verwaltung würde in so einer Situation ein Minimum der technischen Infrastruktur für die Blockchain garantieren, etwa eine Mindestzahl an Nodes. Zudem kann sie je nach Anwendungsfall den Zugang kontrollieren, also wer schreiben und abrufen darf. So sollte etwa bei Schulzeugnissen auf der Blockchain ja nicht jedermann irgendwelche Zeugnisse vergeben dürfen, sondern nur staatliche anerkannte Schule die Abschlusszeugnisse, für die sie akkreditiert sind.	- Zustimmung - "Technische" Koordination

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 91	Research	Die öffentliche Verwaltung ist nicht wegzudenken. Mit der Blockchain kann sich die öffentliche Verwaltung allerdings unterschiedlich aufstellen. Bisheriger Kritikpunkt ist u.a. die dominante Rolle der Verwaltung. Das kann sich wandeln. Andere Akteure kommen kaum in Betracht. Die Interessen anderer Akteure sind zum Teil als profitorientiert einzuordnen oder verfolgen grundsätzlich eigene Interessen. Die öffentliche Verwaltung kann hier als Koordinator von Interessen erscheinen.	- Zustimmung - Verwaltungs als Vertrauensinstanz, interessensneutral
Anonym 41	Research	Ja, wichtig. Selbstorganisation wird womöglich nicht gelingen (= The DAO). Die Verwaltung ist neutral, im Gegensatz zu anderen.	- Zustimmung - Verwaltungs als Vertrauensinstanz, interessensneutral - Selbstorganisation, "führungslos" nicht möglich

Question 2: „If a public service is understood as a process: can a cross-actor public service be implemented completely blockchain-based?“

Fragen-Scope	Complete process coverage - NPG emphasizes disintegrated silos - BC: reduces silos - Experts: But is "complete" disintegration likely?	
Fragetyp	Einfachauswahl	
Anzahl der Teilnehmer (n)	19	
Optionen	Ja	Nein
Aggregierte Ergebnisse		
Gesamtergebnis	Relativ	Absolut
Ja	68,42%	13
Nein	31,58%	6
IT Sol. Prov.	Relativ	Absolut
Ja	87,50%	7
Nein	12,50%	1
Research	Relativ	Absolut

Ja	60,00%	3
Nein	40,00%	2
Public Admin.	Relativ	Absolut
Ja	50,00%	3
Nein	50,00%	3



Übergreifende Analyse:
Hoher Zustimmungswert hinsichtlich vollständiger Abbildung. Ein Drittel hält es jedoch für nicht möglich. Sehr hohe Einigkeit bei den IT Sol. Providern, eher ausgeglichene Meinung bei den restlichen Gruppen.

Teilnehmer	Berufsgruppe	Wert
Anonym 19	IT Sol. Prov.	Ja
Anonym 110	IT Sol. Prov.	Ja
Anonym 35	IT Sol. Prov.	Ja
Anonym 72	IT Sol. Prov.	Ja
Anonym 100	IT Sol. Prov.	Ja
Anonym 144	IT Sol. Prov.	Nein
Anonym 64	IT Sol. Prov.	Ja
Anonym 10	IT Sol. Prov.	Ja
Anonym 57	Public Admin.	Nein
Anonym 5	Public Admin.	Ja
Anonym 127	Public Admin.	Ja

Teilnehmer	Berufsgruppe	Wert
Anonym 101	Public Admin.	Nein
Anonym 15	Public Admin.	Ja
Anonym 33	Public Admin.	Nein
Anonym 27	Research	Ja
Anonym 50	Research	Ja
Anonym 30	Research	Ja
Anonym 91	Research	Nein
Anonym 41	Research	Nein

Question 4: „If the public service cannot be implemented completely blockchain-based: which process elements, if any, could remain with an actor?“

Fragen-Scope	Complete process coverage - NPG emphasizes disintegrated silos - BC: reduces silos - Experts: But is "complete" disintegration likely?
Fragetyp	Freitext
Beschreibung	Begriffsklärung: "Prozesselemente" können vor allem organisatorischer oder technischer Art sein.
Anzahl der Teilnehmer (n)	18
Übergreifende Analyse	- Human interventions required, e.g. for validation tasks - External systems/data and processes, e.g. to company-internal structures/processes

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 110	IT Sol. Prov.	(1) Prozesselemente, bei denen menschliches Ermessen eine Rolle spielt. (2) Prozesselemente, die hoheitliche Aufgaben abdecken (bin hier aber etwas unsicher)	- Ermessensfragen / Spielraum - Hoheitlichkeit / "Aufgabengüte"

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 35	IT Sol. Prov.	Das hängt vom UC ab. Vorgelagert ist die Frage, ob spezifische UC überhaupt mit einer Blockchain besser umgesetzt werden sollten. Für die absolute Mehrzahl hoheitlicher Aufgaben eigenen sich herkömmliche Technologien besser. Ich sehe 2 Hauptkategorien: 1. UCs, wie etwa SSI, die tatsächlich in bestimmten Bahnen stark dezentralisiert werden können. 2. UCs, bei denen DLT sich anbietet, aber primär um föderale oder supranationale Strukturen abzubilden, die bei mehreren staatlichen Akteuren bleiben.	- Hoheitlichkeit / Aufgabengüte
Anonym 72	IT Sol. Prov.	Die Blockchain ist ein geschlossenes Ökosystem auf Basis einer definierten business cases. Benötigt dieser business case Werte von einem externen System, weil dieser innerhalb der Blockchain nicht bereitgestellt werden können, dann muss dieser vom Akteur bereitgestellt werden. Beispiel: Abbildung des Wertpapierhandels. Der Kauf und Verkauf der Wertpapiere zwischen den Akteuren könnte problemlos über die BC abgebildet werden. Der sich ändernde Aktienkurs muss aber integriert werden.	- "Geschlossenes Ökosystem" - Externe Systeme/Daten als nicht abbildbar
Anonym 100	IT Sol. Prov.	Die zentrale Instanz einer Prüfung oder Authentifizierung. Dies kann elektronisch erfolgen und schafft das Vertrauensniveau auf einer private Blockchain.	- Zentrales Prüfen/Authentifizieren

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 144	IT Sol. Prov.	Die Frage ist zu Allgemein! Es gibt kein 100% ja und nein, denn Blockchain ist ein Teil der Lösung und es sollte untersucht werden, in welchen Prozezzschritte es Sinn macht oder wo es eventuell besser ist, eine andere Technologie einzusetzen.	- Blockchain als Teil einer Lösung
Anonym 64	IT Sol. Prov.	Manuelle Verarbeitungsschritte und jede Form von Rechenleistung oder Services, für die die DLT nicht zwingend gebraucht wird.	- Manuelle Tätigkeiten - IT-Services außerhalb der Blockchain ("Externe Systemen/Daten"?!)
Anonym 10	IT Sol. Prov.	Kontinuierliche Verbesserungen, User Feedback Zyklen, nichtdigitale Alternativleistungen für Inklusion	- Analoge Prozesse/Alternativen - Feedback und Verbesserungsprozesse
Anonym 19	IT Sol. Prov.	Je nach Leistung können schwer automatisierbare Validierungsschritte notwendig sein, die bei einem der Akteure verbleiben könnten. In diesem Fall wäre die Überprüfung eines Mitarbeiters Voraussetzung für die Weiterreichung von Materialien an andere involvierte Akteure. Außerdem läge das Ausstellen physischer Dokumente weiterhin beim Akteur selbst.	- Validierung (zentrales Prüfen)
Anonym 57	Public Admin.	„Vollständig“ kann das nicht abgebildet werden. Wenn an einer Verwaltungsleistung auch Unternehmen beteiligt sind, verbleiben sicherlich auch interne Prozesse und ihre Schnittstellen zur Verwaltungsleistung im Unternehmen - und nicht in der Blockchain.	- Externe Systeme, Daten, Prozesse

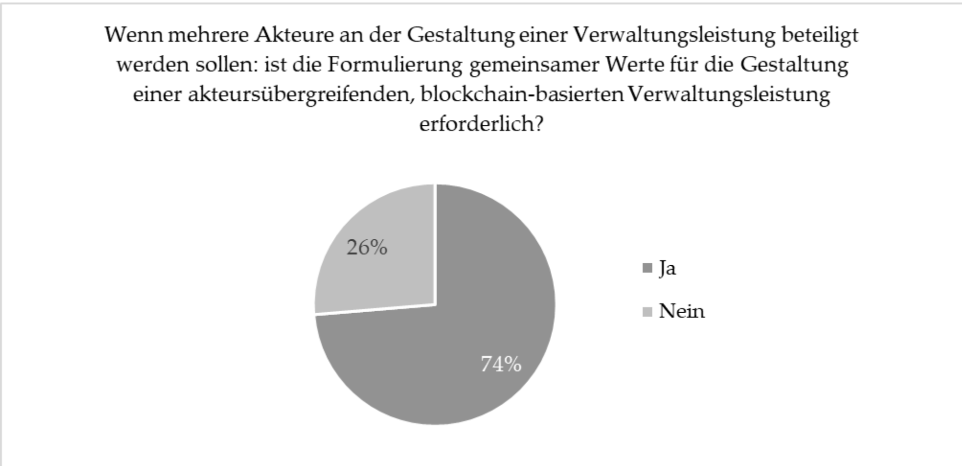
Teilnehmer	Berufsgruppe	Antwort	Analyse
		Es können sowieso nicht alle Daten, zB Dokumente, auf der Blockchain gespeichert werden.	
Anonym 5	Public Admin.	Validierer	- Validierung
Anonym 127	Public Admin.	Wenn Ermesen ausgeübt werden muss bzw. hoheitliche Entscheidungen zu treffen sind oder dies das Gesetz vorschreibt.	- Ermessensfragen / Spielraum - Hoheitlichkeit / "Aufgabengüte"?
Anonym 101	Public Admin.	Die Blockchain ist nur eine Infrastruktur-Komponente, auf deren Grundlage Technologien wie Self sovereign identity, decentralized identity, verifiable credentials (VC) aufsetzen können. Siehe Use Cases der European Blockchain Service Infrastructure. Außerdem können „Legacy Systeme“ angebunden werden. Es wird vermutlich immer ein Personenstandsregister geben. Inhalte daraus können den Bürgerinnen und Bürgern als VC (Meldenachweis) ausgestellt werden und bei Erfordernis „vorgezeigt“ werden.	- Externe Systeme, Daten, Prozesse
Anonym 15	Public Admin.	alle Prozessschritte, die nach einer Verifizierung mittels Blockchain erfolgen.	?
Anonym 33	Public Admin.	Alle, außer der Speicherung der Daten. Eine Blockchain ist nur eine Struktur, um Daten dezentral und unveränderbar abzuspeichern.	- Externe Systeme, Daten, Prozesse - "alles außer Speicherung"

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 27	Research	Ich verwende lieber die Bezeichnung dezentral als die Bezeichnung Blokckchain-basiert. Denn die Veränderung misst sich am Grad der Dezentralisierung der Transaktionen, nicht an der Frage ob die Daten in eine Blockchain oder in eine SQL-Datenbank geschrieben werden. Typischerweise kann man Prozesselemente mit Gatekeeper-Funktion, also z.B. Anspruchsprüfung mit deutlich weniger Aufwand und höherer Zuverlässigkeit zentralisiert abbilden als dezentral.	- Prozesselemente mit Gatekeeper-Funktion, z. B. Validierung
Anonym 50	Research	Aus meiner Sicht stellt sich hier die Frage, ob es sich tatsächlich um eine vollständige Abbildung handeln muss. Evtl. ist es klüger, nur Teilaspekte des besagten Prozesses über eine Blockchain-Lösung abzubilden.	- Grundsatz: muss alles abgebildet werden?
Anonym 91	Research	eigenständigte oder unternehmenseigene Prozesselemente lassen sich nicht derart abbilden	- Externe Systeme, Daten, Prozesse
Anonym 41	Research	Es wird immer etwas zurückbleiben.	Unklare Bedeutung

Question 5: "If multiple actors are to be involved in the design of a public service: is the formulation of shared values necessary for the design of a cross-actor blockchain-based public service?"

Fragen-Scope	Articulation of joint values - NPG: values not as important - BC: also perceives values not as primary driver - Experts: do they agree? Are values required?	
Fragetyp	Einfachauswahl	
Beschreibung	Begriffsklärung: "Werte" werden hier als Frage der <u>inneren</u> Einstellung und Motivation betrachtet. Dies können z. B. das Gerechtigkeitsempfinden, das Sicherheitsbedürfnis oder der Wunsch nach Selbstbestimmung sein.	
Anzahl der Teilnehmer (n)	19	
Optionen	Ja	Nein
Aggregierte Ergebnisse		
Gesamtergebnis	Relativ	Absolut
Ja	73,68%	14
Nein	26,32%	5

IT Sol. Prov.	Relativ	Absolut
Ja	75,00%	6
Nein	25,00%	2
Research	Relativ	Absolut
Ja	60,00%	3
Nein	40,00%	2
Public Admin.	Relativ	Absolut
Ja	83,33%	5
Nein	16,67%	1



Übergreifende Analyse
- Hohe Zustimmungswerte bei IT Sol. Prov. und Public Administration. Unentschlossenheit im Bereich der Forschung. - Wann werden Werte benötigt: nur im Designprozess oder (auch) als "kommunikatives Mittel" während der Lebensdauer einer BC-basierten Verwaltungsleistung? - Technisches Setup als Ausdruck gemeinsamer Werte

Teilnehmer	Berufsgruppe	Wert	Kommentar	Analyse
Anonym 110	IT Sol. Prov.	Ja	/	/
Anonym 35	IT Sol. Prov.	Nein	Wesentlich ist hier die Rechtslage, die etwaige Grundsätze und Normen festlegt. Dort, wo Verwaltungsleistungen per DLT auch Dritte einbinden soll, um Prozesse zu beschleunigen, muss die Rechtslage dies hergeben. Da hier tendenziell eine Öffnung des Staates oder von Verwaltungsverfahren gemeint ist, sind ausschließlich Rechtsnormen relevant. Werte könnten bestenfalls Grundannahmen in der Digitalisierung leiten, wie z.B.Transparenz und offene Daten, aber nicht einzelne	- Rechtslage als Ersatz für gemeinsame Werte - Werte hätten nur mittelbaren Charakter, ohne große Auswirkung

Teilnehmer	Berufsgruppe	Wert	Kommentar	Analyse
			Verwaltungsleistungen, und auch hier wäre der Effekt sehr indirekt und eher politisch.	
Anonym 72	IT Sol. Prov.	Nein	/	/
Anonym 100	IT Sol. Prov.	Ja	Dies wäre schon allein deshalb erforderlich, da die Empfänger von Verwaltungsleistungen (Bürger/Unternehmen) eine klare Orientierung suchen werden, welchen Werten/Normen diese Lösung folgt. (Gilt im übrigen für alle Verwaltungsleistungen).	- Werte als Orientierung für Nutzer*innen
Anonym 144	IT Sol. Prov.	Ja	/	/
Anonym 64	IT Sol. Prov.	Ja	Immer sinnvoll, um die Zusammenarbeit auf gemeinsame Annahmen zu setzen und den Fortschritt über Prinzipien zu erhöhen	/
Anonym 10	IT Sol. Prov.	Ja	/	/
Anonym 19	IT Sol. Prov.	Ja	/	/
Anonym 57	Public Admin.	Ja	Könnte für eine gemeinsame Zielformulierung wichtig sein.	- Gemeinsame Zielformulierung - also im Designprozess
Anonym 5	Public Admin.	Ja	/	/
Anonym 127	Public Admin.	Nein	/	/

Teilnehmer	Berufsgruppe	Wert	Kommentar	Analyse
Anonym 101	Public Admin.	Ja	Auf jeden Fall, da es zu viele unterschiedliche DLT-Varianten gibt (Bitcoin, …). Die Verwaltung muss immer das Vertrauen der Bürgerinnen und Bürger in ihre Arbeitsweise sicherstellen. Die Govdigital eG ist ein gutes Beispiel.	- Werte zur Vertrauensbildung bei den Nutzern
Anonym 15	Public Admin.	Ja	/	/
Anonym 33	Public Admin.	Ja	Die Datenstruktur an sich ist keine Verwaltungsleistung. Eine m. E. vergleichbar sinnvolle Frage wäre: "Wenn mehrere Akteure an der Gestaltung einer Verwaltungsleistung beteiligt werden sollen: ist die Formulierung gemeinsamer Werte für die Gestaltung einer akteursübergreifenden Verwaltungsleistung, bei der die Daten auf einem FAT32-Dateisystem gesichert werden, erforderlich?	- Grundsatz
Anonym 27	Research	Nein	/	/
Anonym 50	Research	Ja	/	/

Teilnehmer	Berufsgruppe	Wert	Kommentar	Analyse
Anonym 30	Research	Nein	Entscheidend sind die technischen Eigenschaften der Blockchain und daraus resultierenden Handlungsmöglichkeiten (etwa für deviantes Verhalten). D.h. die Einigung auf die technische Umsetzungsform ist zumindest implizit eine Einigung auf gemeinsame Werte bzw. ein konsensfähiger Interessenausgleich. Die Stärke der Blockchain ist ja gerade, dass die Akteure nicht mit durch Grundsatzpapiere auf Kurs gehalten werden müssen, sondern die Technik einen festen Rahmen vorgibt.	- Werte hätten nur mittelbaren Charakter, die sich in den technischen Eigenschaften manifestieren
Anonym 91	Research	Ja	/	/
Anonym 41	Research	Ja	/	/

Question 6a: „In your view, what POSITIVE incentives for users could be effective in ensuring the use of a cross-actor, blockchain-based public service?"

Fragen-Scope	- NPG: Incentives play marginal role in governance processes - BC builds on incentives - Experts: which role play incentives?
Fragetyp	Freitext
Beschreibung	Begriffsklärung: "Incentives" werden als äußere Anreize betrachtet, um eine angestrebte Handlung oder Verhaltensweise zu motivieren. <u>Positive</u> Incentives können in diesem Sinne z. B. steuerliche Entlastungen sein.
Anzahl der Teilnehmer (n)	19
Übergreifende Analyse	- Keine Technologie-Betonung sinnvoll - Nutzen einer digitalen Verwaltungsleistung im Vordergrund - Effizienzverbesserungen häufig genannt - Kommunikation der positiven Effekte gelegentlich betont

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 110	IT Sol. Prov.	Schnelligkeit, Kostenersparnis (bis hin zu kostenlos), Gestaltungsmöglichkeit / Partizipation an Weiterentwicklung, Wertschätzung (Awards), Nennung in Publikationen (mit Einverständnis), Zuverlässigkeit, Transparenz.	Effizienz, Partizipation, Anerkennung/Wertschätzung
Anonym 35	IT Sol. Prov.	Für Bürger:innen und Unternehmen ist i.d.R. nicht sichtbar, ob hinter eine spezifischen Leistung eine DLT oder ein herkömmliches (vereiltes) Register steht. Incentives zur Nutzung haben also nichts mit der Technologie zu tun, sondern mit dem Versprechen, dass z.B. eine digitale Leistung schneller ginge. Der incentive für öffentliche Einrichtungen kann hingegen durchaus eine Kosteneinsparung sein.	- Keine technologie-betonten/technologie-gerichteten zusätzlichen Incentives erforderlich, sondern eher vom Nutzen her kommend - Effizienz
Anonym 72	IT Sol. Prov.	Der "Anreiz" kann vieles sein. Im Kontext von dem genannten Identity-Management-Beispiel wäre der Anreiz natürlich, dass die personenbezogenen Daten sicherer wären. D.h. wenn die mit Blockchain umgesetzte Lösung eine Verbesserung für den Nutzer darstellt und er diesen Nutzen direkt erkennt, ist das aus meiner Sicht der beste "Anreiz".	- (Daten-)Sicherheit - Nutzen für den Nutzer kommunizieren
Anonym 100	IT Sol. Prov.	Weniger formale Hürden (Formulare, Beschaffung von Dokumenten etc.) und deutliche Zunahme der Geschwindigkeit.	Effizienz, geringere Einstiegs-/Nutzungshürden

Teilnehmer	Berufsgruppe	Antwort	Analyse
		Zum Beispiel im Standesamtsbereich mit Urkunden oder im Zoll bei den Zollfeklarationen.	
Anonym 144	IT Sol. Prov.	Steuerlichte Entlastung, Beteiligung an Transaktion-Kosten	Monetäre Anreize
Anonym 64	IT Sol. Prov.	Beschleunigung des Prozesses durch Automatisierung, geringere Verwaltungskosten, mehr Transparenz (beispielsweise über anonymisierte statistische Auswertungen)	Effizenz, Transparenz
Anonym 10	IT Sol. Prov.	Intelligente Kopplung zusammenhängender Verwaltungsleistungen, Stichwort Once Only. Historisierung und Kontrolle der eigenen Daten als Zusatzservice. Kosten bzw. Gebührenvorteile	Effizienz, inkl. Prozessübergänge / Once Only Zusätzliche Funktionalitäten für Nutzer*innen
Anonym 19	IT Sol. Prov.	Hervorheben der Vorteile: schnellere Bearbeitung, direkte und ortsunabhängige Verfügbarkeit, geringere Bearbeitungsgebühr Integration mit anderen digitalen Prozessen Kommentar: Der Ansatz, Nutzer durch Incentives davon zu überzeugen, eine BLOCKCHAIN-BASIERTE Verwaltungsleistung zu nutzen, ist komplett fehlgeleitet. Ziel sollte es sein, eine konsistente, effiziente, leicht verwendbare DIGITALE Verwaltungsleistung anzubieten. Dass diese im Hintergrund auf	- keine technologie-betonten/technologie-gerichteten zusätzlichen Incentives erforderlich - Effizienz

Teilnehmer	Berufsgruppe	Antwort	Analyse
		einer Blockchain abläuft sollte im Idealfall weder betont werden, noch auffallen.	
Anonym 57	Public Admin.	Positive Berichterstattung über die Verwaltungsleistung und die beteiligten Akteure/Nutzer. Finanzielle Anreize?	- Positive Kommunikation zur Leistung und den Akteuren - Monetäre Anreize
Anonym 5	Public Admin.	Synergieeffekte für das eigene Geschäftsmodell oder einen anderen Mehrwert für den Endnutzer (z.B. Bequemlichkeit, Schnelligkeit, Friktionslosigkeit) sind die größte Incentives. Das sollte von medial gut begleitet werden und alle beteiligten Behörden sollten sich bei der strategischen Ausrichtung in die gleiche Richtung laufen.	- Effizienz - Positive Kommunikation
Anonym 127	Public Admin.	Es wird nicht zulässig sein, für Verwaltungsleistungen, die auf diese Art abgewickelt werden, Incentives zu geben. Jedoch sind es Schnelligkeit, Korrektheit und Unveränderlichkeit der Dinge, die als Anreiz verstanden werden können. Entlastung durch Automatisierung (z.B. SSI)	- keine technologie-betonten/technologie-gerichteten zusätzlichen Incentives - Effizienz, Sicherheit

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 101	Public Admin.	Die Frage ist eigentlich so nicht zu beantworten. Aus Sicht der Bürgerinnen und Bürger sowie der Unternehmen müssen Verwaltungsleistungen sicher, wirtschaftlich und möglichst zügig erbracht werden. Die Technik ist vermutlich den Konsumenten egal (Ob Datenbank oder Blockchain; Klingeldraht oder Highspeed Internet). Das Prinzip des „neuen Verwaltungs-Ökosystem", veröffentlicht auf https://dezentraleverwaltung.de, kann eine Orientierung geben.	- keine technologie-betonten/technologie-gerichteten zusätzlichen Incentives
Anonym 15	Public Admin.	schnellere Inanspruchnahme von Dienstleistungen, also direkter Mehrwert für Bürger:innen.	- Effizienz
Anonym 33	Public Admin.	Die Transparenz und Sicherheit der Datenhaltung, die Manipulationssicherheit der gespeicherten Daten. Würde z. B. die Aktenführung einer Verwaltungseinheit blockchain-basiert erfolgen, so gäbe es keinen Verdacht mehr hinsichtlich einer Manipulation von Inhalten.	- Transparenz, Sicherheit
Anonym 27	Research	Eine optimierte User Experience (UX), die in einem user-centric design Prozess entwickelt wurde (entgegen der üblichen Implementierung einer Behörden/ Silostruktur-zentrierten Entwicklung).	- User Experience

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 50	Research	Die Aussicht auf entlastende Prozesse, um z.B. Routine-Tätigkeiten zu automatisieren, könnte im Zuge der sich abzeichnenden Lücke an Mitarbeiter:innen motivieren	- Effizienz
Anonym 30	Research	Schneller und eventuell günstigere Leistungserbringung durch elektronische Abwicklung. Einfache Schnittstellen zu bestehenden IT-Lösungen der Akteure, also nahtloses Einbetten in deren Prozesse. Wegfallen von irgendwelchen Akkreditierungen. Wegfallen von teuren Intermediären.	- Effizienz, inkl. Prozessübergänge
Anonym 91	Research	Es sollten die Vorteile der Nutzung betont werden.	- Kommunikation der Nutzung
Anonym 41	Research	Braucht es dedizierte Incentives, wenn eine Verwaltungsleistung blockchain-basiert umgesetzt wird? Technologie sollte nicht auffallen.	- keine technologie-betonten/technologie-gerichteten zusätzlichen Incentives

Question 6b: „In your view, what NEGATIVE incentives for users could be effective in ensuring the use of a cross-actor, blockchain-based public service?“

Fragen-Scope	- NPG: Incentives play marginal role in governance processes - BC builds on incentives - Experts: which role play incentives?
Fragetyp	Freitext
Frage	Welche NEGATIVEN Incentives für Nutzer*innen könnten aus Ihrer Sicht effektiv sein, um die Nutzung einer akteursübergreifenden, blockchain-basierten Verwaltungsleistung sicherzustellen?
Beschreibung	Begriffsklärung: "Incentives" werden als äußere Anreize betrachtet, um eine angestrebte Handlung oder Verhaltensweise zu motivieren. Ein <u>negativer</u> Incentive kann in diesem Sinne z. B. gesetzlicher Zwang sein.
Anzahl der Teilnehmer (n)	19
Übergreifende Analyse	- Höhere Hürden/ geringere Anreize für traditionelle Nutzung - Teilweise auch Sinn von negativen Incentives in Frage gestellt - Nutzungsverpflichtung, v.a. per Gesetz

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 110	IT Sol. Prov.	Höhere Kosten bei Beschreitung traditioneller Wege, geringere Priorisierung (dauert länger). Grundsätzlich sollte versucht werden, auf negative Incentives zu verzichten.	- Verzicht auf negative Incentives empfohlen - Höhere Hürden/ geringere Anreize für traditionelle Nutzung
Anonym 35	IT Sol. Prov.	Identisch zur Frage der positiven Incentives wird es einem Nutzer oder Unternehmen von außen nicht ersichtlich sein, was für eine Technologie sich hier einem Verwaltungsangebot verbirgt. Zudem kann es auch rechtlich hier wenig "harte" incentives geben, die technologiespezifisch sind. Die primären Incentives wären also z.B. höhere Geschwindigkeit, Bequemlichkeit, Transparenz, die aber nicht DLT-spezifisch sind.	- Keine technologie-zentrierten rechtlichen Zwänge vorstellbar
Anonym 72	IT Sol. Prov.	Gesetzlicher Zwang kann "negativ" sein, oder aber auch von Unternehmen gewünscht werden. Beispielsweise sind regulierte Unternehmen wie Banken stark daran interessiert, dass das rechtliche Rahmenwerk für Blockchain existiert, damit sich ihre Investitionen lohnen. D.h. Gesetzgebungen können Zwang und Erlösung sein. Tatsächlich müssten Standards/Gesetze hinsichtlich der technologischen Umsetzung existieren, damit Unternehmen sich daran richten können/müssen.	- Rechtlicher Zwang auch vorteilhaft für Nutzer

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 100	IT Sol. Prov.	Die Verpflichtung zur Nachweisführung auf anderem (papiergebundenen oder elektronischem) Wege bis hin zu gesetzlich verbindlichen Regelungen (analog „Digital First“ bis hin zu „Digital only“).	- Höhere Hürden/ geringere Anreize für traditionelle Nutzung
Anonym 144	IT Sol. Prov.	Verpftlichung vom Gesetzgeber und Vorgaben	- Rechtlicher Zwang
Anonym 64	IT Sol. Prov.	Umfangreiche technische Voraussetzungen oder ein langer Anmeldeprozess, zusätzliche Gebühren, neue/abweichende Standards	- Höhere Hürden/ geringere Anreize für traditionelle Nutzung - Evtl. wurde die Frage nicht richtig verstanden
Anonym 10	IT Sol. Prov.	Höhere Kosten bei Nichtnutzung. Schlechtere Erreichbarkeit zB Öffnungszeiten von Ämtern. Weniger Automatisierung und Intelligenz in Prozessabläufen und Nutzererfahrung	'- Höhere Hürden/ geringere Anreize für traditionelle Nutzung - Penalties bei Nichtnutzung
Anonym 19	IT Sol. Prov.	Änderung der Kommunikationsstrategie: digitale, blockchain-basierte Leistungen als default Option, während physische Leistungen teurer gemacht, und als Ausnahme positioniert werden.	- Höhere Hürden/ geringere Attraktivität für traditionelle Nutzung
Anonym 57	Public Admin.	Sind „Bestrafungen“ wirklich sinnvoll? Gesetzlicher Zwang ist natürlich sehr effektiv, könnte aber die Nutzerakzeptanz schmälern.	- Verzicht auf negative Incentives empfohlen

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 5	Public Admin.	Eine gesetzliche Verpflichtung. Nach hinten rutschen in der Priorität bei z.B. Behandlung von Anträgen.	- Rechtlicher Zwang - Höhere Hürden/ geringere Attraktivität für traditionelle Nutzung
Anonym 127	Public Admin.	Sorge, Aufgaben zu verlieren, auf Verwaltungsseite. Beim Bürger Bedenken bzgl. datenschutz. Die Blockchain-Techologie birgt eine inhärente Dinge, die der DSGVO widersprechen, wenn man dafür keine technischen Lösungen findet (z.B. Nicht-Löschbarkeit von Daten, beim originären Blockchain-Gedanken gibt es keine zudem zuständige Stelle etc.)	- Grundsatz - Evtl. wurde die Frage nicht richtig verstanden
Anonym 101	Public Admin.	Wie in Frage 4.1 schon dargestellt, ist die Technik den Konsumenten von Verwaltungsleistungen vermutlich egal.	- Grundsatz
Anonym 15	Public Admin.	eine Verpflichtung zur Nutzung.	- Nutzungsverpflichtung
Anonym 33	Public Admin.	Die Bepreisung des Mehraufwands durch die einheits-individuelle Sicherstellung der Sicherheit der Datenspeicherung.	- Höhere Hürden/ geringere Attraktivität für traditionelle Nutzung
Anonym 27	Research	Die gleichen negativen Incentives die auch bei herkömmlichen, zentralisierten Verwaltungsleistungen bestehen: z.B. Wer seine Steuererklärung nicht abgibt, der bekommt keine Rückzahlung, oder wer den Antrag nicht stellt, bekommt die gewünschte Leistung nicht.	- Eliminierung von alternativen oder traditionellen Wegen, um Nutzung der BC-basierten Leistung alternativlos zu machen

Teilnehmer	Berufsgruppe	Antwort	Analyse
Anonym 50	Research	Vorgabe der Dienststelle	- Nutzungsverpflichtung
Anonym 30	Research	Gesetzlicher Zwang. Höhere Kosten und Laufzeiten für von der Norm abweichende Verfahren. Reputationsverlust (Warum will der Akteur seine Handlungen nicht auf einer Blockchain aufzeichnen lassen?)	- Rechtlicher Zwang - Höhere Hürden/ geringere Attraktivität für traditionelle Nutzung - Reputationsverlust
Anonym 91	Research	Gesetzlicher Zwang scheint nicht erforderlich	- Verzicht auf negative Incentives empfohlen
Anonym 41	Research	Technologie sollte grundsätzlich nicht auffallen. Incentives braucht es nur dann, wenn die Nutzerinteraktion verändert wird.	- Grundsatz

Questions 7/8: „What is the relevance of blockchain governance of a blockchain-based public service to user acceptance of the overall public service? (users are e.g,. citizens or companies).“

Fragen-Scope	- BC setting: influence on user participation - BC: Public admin not willing share every responsibility - Does participation/work on BC governance level impact the participation on user level?	
Fragetyp	Bewertungsskala	
Beschreibung	Bitte begründen Sie Ihre Antwort im Meinungsfeld. Begriffsklärungen: - "Nutzer" sind z. B. Bürger*innen oder Wirtschaftsteilnehmer - "Governance" bezieht sich insb. auf Steuerung, Regelung und Aufbau der technischen Blockchain-Lösung (z. B. Aufbau als public oder private Blockchain, Auswahl des Konsens-Algorithmus)	
Anzahl der Teilnehmer (n)	19	
Bereich	**Untere Grenze**	**Obere Grenze**
Nicht relevant	0	0
Nur bedingt relevant	1	1

Etwas relevant	2	2
Sehr relevant	3	3
Äußerst relevant	4	4
Aggregierte Ergebnisse		
Bereich (Gesamt)	Relativ	Absolut
Nicht relevant	0,00%	0
Nur bedingt relevant	10,53%	2
Etwas relevant	31,58%	6
Sehr relevant	26,32%	5
Äußerst relevant	31,58%	6
IT Sol. Prov.	Relativ	Absolut
Nicht relevant	0,00%	0
Nur bedingt relevant	0,00%	0
Etwas relevant	25,00%	2
Sehr relevant	25,00%	2
Äußerst relevant	50,00%	4

Public Admin.	Relativ	Absolut
Nicht relevant	0,00%	0
Nur bedingt relevant	0,00%	0
Etwas relevant	50,00%	3
Sehr relevant	33,33%	2
Äußerst relevant	16,67%	1
Research	Relativ	Absolut
Nicht relevant	0,00%	0
Nur bedingt relevant	40,00%	2
Etwas relevant	20,00%	1
Sehr relevant	20,00%	1
Äußerst relevant	20,00%	1
Übergreifende Analyse	- Blockchain Governance für die Mehrheit mindestens sehr relevant. Vor allem IT Sol. Prov. Halten es für mehrheitlich äußerst relevant. Nur die Forschung zeigt sich hinsichtlich der Relevanz im Vergleich zurückhaltender. - BC Governance mit Einfluss auf Nutzervertrauen, z. B. hinsichtlich	

Beteiligungsstrukturen, IT-Sicherheit
- Bedeutung der Governance auch vom Anwendungsfall abhängig

Teilnehmer	Numerisch	Text	Berufsgruppe	Kommentar	Analyse
Anonym 110	2	Etwas relevant	IT Sol. Prov.	Governance hängt mit Vertrauen zusammen.	Einfluss auf Vertrauen
Anonym 35	3	Sehr relevant	IT Sol. Prov.	Am Beispiel des Covid-Impfasses sowie der Luca-App zeigt sich, dass eine Governance nur dann relevant ist, wenn es sich um besonders sensible Daten handelt und die Governance nicht datenschutzfreundlich erfolgt, also zu viele Daten in den Händen Privater sind. Es ist also kein positiver Faktor, eher ein hygiene Faktor (schlecht, wenn nicht vorhanden/schlecht).	- Governance nicht pauschal wichtig. Abhängig vom Anwendungsfall (z. B. bei sensiblen Daten)
Anonym 72	4	Äußerst relevant	IT Sol. Prov.	Für den business case und für die technische Umsetzung ist die Governance-Variante (public/private/consortium BC, Konsens-Algorithmus) extrem wichtig. Für den Bürger ist das	- Für Nutzer ist Governance nicht ersichtlich, damit für Akzeptenz nicht entscheidend

Teilnehmer	Numerisch	Text	Berufsgruppe	Kommentar	Analyse
				im Zweifel nicht ersichtlich. Das hängt dann vom business case ab. Ich denke die Frage hätte eher lauten müssen: "Welche Governace-Lösung macht für Verwaltungsleistungen Sinn?".	
Anonym 100	4	Äußerst relevant	IT Sol. Prov.	/	/
Anonym 144	4	Äußerst relevant	IT Sol. Prov.	/	/
Anonym 64	3	Sehr relevant	IT Sol. Prov.	Hängt vom Anwendungsfall ab	- Governance nicht pauschal wichtig. Abhängig vom Anwendungsfall
Anonym 10	2	Etwas relevant	IT Sol. Prov.	/	/
Anonym 19	4	Äußerst relevant	IT Sol. Prov.	Sehr relevant, da Governance zum einen die der Automatisierung zugrundeliegenden Regeln festlegt. Sind diese suboptimal, wird Leistung dauerhaft ebenfalls suboptimal laufen und zu geringer Akzeptanz führen. Außerdem ist die Governance	- Governance-Entscheidungen haben Einfluss auf Quälität der Lösung, damit auch Einfluss auf Nutzerakzeptanz - Einfluss auf Vertrauen

Teilnehmer	Numerisch	Text	Berufsgruppe	Kommentar	Analyse
				eine Chance, Vertrauen für das neuartige Angebot zu bilden.	
Anonym 57	2	Etwas relevant	Public Admin.	Das Setup könnte die Einfachheit des Nutzer-Zugriffs und damit die Akzeptanz beeinflussen. Als Nutzer könnte für mich auch von Interesse sein zu wissen, wer bei der Blockchain Technik das Sagen hat. Sind Monopolisten oder Big Tech beteiligt?	- Beteiligungsstrukturen relevant - Governance-Entscheidungen haben Einfluss auf Quälität der Lösung, damit auch Einfluss auf Nutzerakzeptanz
Anonym 5	4	Äußerst relevant	Public Admin.	/	/
Anonym 127	2	Etwas relevant	Public Admin.	Letztenendes fragt der Nutezr, wenn etwas in seinem Sinne gut funktioniert, selten nach der Technologie dahinter, nur zu Beginn.	- Governance-Aspekte zu Beginn für Nutzer relevant. Im Zeitverlauf weniger relevant
Anonym 101	3	Sehr relevant	Public Admin.	/	/
Anonym 15	2	Etwas relevant	Public Admin.	die Technik ist dann zweitrangig, wenn der Vorteil für den Nutzer überwiegt.	- Für Nutzer wenig relevant, wenn Nutzen überwiegt
Anonym 33	3	Sehr relevant	Public Admin.	/	/

Teilnehmer	Numerisch	Text	Berufsgruppe	Kommentar	Analyse
Anonym 27	2	Etwas relevant	Research	Die Blockchain-Governance hat nur einen mittelbaren Einfluss auf die Nutzerakzeptanz. In erster Linie muss die Anwendung eine gute UX haben, und der Nutzer muss Vertrauen in die IT-Sicherheit (Vertraulichkeit, Verfügbarkeit, Integrität, Authentizität) haben. Um gute UX und IT-Sicherheit zu gewährleisten spielt die gewählte Blockchain-Governance wiederum eine Rolle.	- Mittelbar relevant - Für gute Verwendtbarkeit und Vertrauen in IT-Sicherheit braucht es Governance
Anonym 50	4	Äußerst relevant	Research	Ohne entsprechende Governance wird es kaum Akzeptanz geben, da die Sorge um Manipulierbarkeit und fehlende Sicherheit den Nutzer / Bürger:innen abschrecken.	- Einfluss auf Vertrauen - Governance mit Einfluss auf Sicherheit/ Manipulierbarkeit
Anonym 30	1	Nur bedingt relevant	Research	/	/
Anonym 91	1	Nur bedingt relevant	Research	/	/
Anonym 41	3	Sehr relevant	Research	/	/

Questions 9/10: „What impact might the use of a consortium blockchain have on adoption by public service users?“

Fragen-Scope	Challenge the degree of De-centralization/ self-organization - BC: few players in charge of blockchain system (= rather centralized) - BC are arguing in favor for increased user benefits --> do experts agree?	
Fragetyp	Bewertungsskala	
Beschreibung	Bitte begründen Sie Ihre Antwort im Meinungsfeld. Begriffsklärungen: - "Nutzer" sind z. B. Bürger*innen oder Wirtschaftsteilnehmer - "In einer Konsortium-Blockchain wird der Konsensprozess von einer vorab festgelegten Gruppe kontrolliert... Das Recht, die Blockchain zu lesen und Transaktionen auszuführen, kann jedem oder nur den Teilnehmern gewährt werden." (SAP, 2021)	
Anzahl der Teilnehmer (n)	19	
Bereich	Untere Grenze	Obere Grenze

Überhaupt keinen Einfluss	0	0
Nur bedingt Einfluss	1	1
Etwas Einfluss	2	2
Großer Einfluss	3	3
Sehr großer Einfluss	4	4
Aggregierte Ergebnisse		
Bereich (Gesamt)	Relativ	Absolut
Überhaupt keinen Einfluss	0,00%	0
Nur bedingt Einfluss	21,05%	4
Etwas Einfluss	47,37%	9
Großer Einfluss	21,05%	4
Sehr großer Einfluss	10,53%	2
IT Sol. Prov.	Relativ	Absolut
Überhaupt keinen Einfluss	0,00%	0
Nur bedingt Einfluss	12,50%	1
Etwas Einfluss	37,50%	3

Großer Einfluss	25,00%	2
Sehr großer Einfluss	25,00%	2
Public Admin.	Relativ	Absolut
Überhaupt keinen Einfluss	0,00%	0
Nur bedingt Einfluss	33,33%	2
Etwas Einfluss	33,33%	2
Großer Einfluss	33,33%	2
Sehr großer Einfluss	0,00%	0
Research	Relativ	Absolut
Überhaupt keinen Einfluss	0,00%	0
Nur bedingt Einfluss	20,00%	1
Etwas Einfluss	80,00%	4
Großer Einfluss	0,00%	0
Sehr großer Einfluss	0,00%	0
Übergreifende Analyse	- Einfluss einer Konsortium-Lösung mehrheitlich nur etwas Einfluss beigemessen. IT Sol. Prov. messen dem	

Thema die stärkste Bedeutung zu.
- Relevanz eher gering eingeschätzt, weil Nutzen der Verwaltungsleisung stärker betont wird
- Wahl des Governance-Modells, auch Beteiligungsstruktur, relevant für Nutzervertrauen
- Perspektive einer konsortialen Lösung kritisch hinterfragt

Teilnehmer	Berufsgruppe	Text	Nummerisch	Kommentar	Analyse
Anonym 110	IT Sol. Prov.	Großer Einfluss	3	Vertrauen in Staat schätze in DE grundsätzlich hoch ein. Gleichzeitig wird Transparenz sichergestellt	- Staat als vertrauensstiftender Konsortialpartner?
Anonym 35	IT Sol. Prov.	Sehr großer Einfluss	4	Hinter dieser Frage steht weniger die Relevant des vorhandenseins "irgendeines" Konsortiums. Ich denke aber, dass die Nutzung von "verwaltungsinternen" bzw. verwaltungsbetriebenen Blockchains (siehe govdigital/govchain), die primär die Abbildung von föderalen oder supranationalen Strukturen zum Ziel haben, Akzeptanz fördern bzw. misstrauen senken.	- Zusammensetzung von Konsortien abhängig von der Leistung (bzw. den darin behandelten Daten)

Teilnehmer	Berufsgruppe	Text	Nummerisch	Kommentar	Analyse
				Privatwirtschaftliche oder gemischte Konsortien werden sicherlich nur für klar definierte, unkritische Daten akzeptabel sein. Voll-öffentliche Blockchains (vgl. Ethereum etc) werden daher für Verwaltungshandeln im hoheitlichen Rahmen wenig relevanz haben, sondern nur Rand-Use-Cases bedienen, die ggf. nicht hoheitlich sind, aber staatliche Zusatzangebote (Beispiel: Organspendeerklärung).	
Anonym 72	IT Sol. Prov.	Nur bedingt Einfluss	1	Wie gesagt, dem Nutzer "Bürger" ist das vermutlich egal, wenn er das Symbol der Bundesregierung auf der Seite sieht. Er vertraut der Seite und hinterfragt nicht die technische Umsetzung. Auch hier hätte aus meiner Sicht die Frage lauten müssen "Macht eine Konsortium-Blockchain für die öffentliche Verwaltung Sinn? Wenn ja, nennen Sie Beispiele..."	- Für Nutzer ist Beteiligungsstruktur nicht ersichtlich, damit für Akzeptenz nicht entscheidend
Anonym 100	IT Sol. Prov.	Großer Einfluss	3		

Teilnehmer	Berufsgruppe	Text	Nummerisch	Kommentar	Analyse
Anonym 144	IT Sol. Prov.	Etwas Einfluss	2	Ich hoffe nicht viel, da für den Bürger die Dienstleistung im Vordergrund stehen sollte.	- Dienstleistung für Nutzer im Vordergrund, nicht "Organisation der Technik"
Anonym 64	IT Sol. Prov.	Sehr großer Einfluss	4	Insbesondere für gewerbliche Nutzer kann dies sehr vorteilhaft sein, weil so öffentlich Vertrauen und ein Pull-Moment geschaffen werden kann.	- Konsortium zur Vertrauensförderung
Anonym 10	IT Sol. Prov.	Etwas Einfluss	2		
Anonym 19	IT Sol. Prov.	Etwas Einfluss	2	Grundsätzlich sollte der Service nicht durch Blockchain beworben werden, sondern durch bessere Nutzerfreundlichkeit. Falls doch Blockchain im Vordergrund steht kann eine Konsortium-Blockchain kurzfristig positiven Einfluss haben, da sie konzeptionell näher an bekannten, geschlossenen Systemen ist. Langfristig, mit steigendem Verständnis der Technologie, eher negativer Einfluss, da solche Systeme in Sicherheit und	- Wahl einer Konsortium-Lösung nur kurzfristig vorteilhaft, langfristig benachteiligt gegenüber public Blockchains - Dienstleistung für Nutzer im Vordergrund, nicht "Organisation der Technik"

Teilnehmer	Berufsgruppe	Text	Nummerisch	Kommentar	Analyse
				Interoperabilität offenen Blockchains unterlegen sind.	
Anonym 57	Public Admin.	Etwas Einfluss	2	Public Blockchains sind zu bevorzugen. Sie entsprechen mehr der ursprünglichen Idee der Blockchain-Technologie.	- Konsortium gegen Idee der Blockchain-Technologie
Anonym 5	Public Admin.	Nur bedingt Einfluss	1	Es kommt darauf an, aus welchen Akteuren das Konsortium besteht. Ich glaube eine nur auf Public Blockchain basierte Verwaltungsleistung ist nicht realistisch umzusetzen.	- Beteiligungsstruktur wichtig - Nur Public Blockchain nicht realistisch
Anonym 127	Public Admin.	Etwas Einfluss	2	Die Schwierigkeit wird sein, wer bildet das Konsortium und hat damit weitere rechte als andere.	- Aufbau und Betrieb des Konsortiums schwierig
Anonym 101	Public Admin.	Großer Einfluss	3	Wie bereits vorher ausgeführt, dürfte die Technologie für die Akzeptanz von Verwaltungsleistungen eher eine untergeordnete Rolle spielen. Allerdings können neue Technologien, wenn sie nicht sensible und weise eingeführt werden, schnell	- Für Nutzer ist Beteiligungsstruktur nicht ersichtlich, damit für Akzeptenz nicht entscheidend - Erklärung der Governance

Teilnehmer	Berufsgruppe	Text	Nummerisch	Kommentar	Analyse
				schlechtgeredet werden. Da landläufig Blockchain = Cryptowährung = Bitcoin gesetzt wird, könnte die Darstellung der Governance (permissions DLT, Konsortium wie z.B. IDunion) flankiert mit einem Informationsangebot, helfen.	als vertrauensfördernde Maßnahme
Anonym 15	Public Admin.	Nur bedingt Einfluss	1	ich gehe von einem untergeordneten Einfluss aus, da UC für die Akzeptanz entscheidend sein wird.	- Dienstleistung für Nutzer im Vordergrund, nicht "Organisation der Technik"
Anonym 33	Public Admin.	Großer Einfluss	3		
Anonym 27	Research	Etwas Einfluss	2	Vorteil: Geringerer Stromverbrauch, weniger Aufwand für Protokollupgrades als bei einer offenen/permissionless Lösung. Noch weniger Stromverbrauch und noch einfacheres Updatemanagement hat allerdings eine klassische zentrale SQL-Datenbank. Nachteil: Eine offene permissionless chain wie Bitcoin ist zuverlässiger gegen Datenmanipulation (Timestamping-	- Wahl eines Governance-Modells hat Einfluss auf IT-/Datensicherheit

Teilnehmer	Berufsgruppe	Text	Nummerisch	Kommentar	Analyse
				Anwendungen in der öffentlicher Verwaltung).	
Anonym 50	Research	Etwas Einfluss	2	Prinzipiell wird der einzelne Nutzer / Bürger:innen wahrscheinlich gar nicht so ein großes Augenmerk auf den Konsens-Mechanismus legen. Für den Nutzer ist die Sicherheit gepaart mit Bequemlichkeit im Zweifelsfalle höher einzustufen. Aber, langfristig gesehen wird die Zustimmung an konsortialen Blockchain-Lösungen sinken.	- Dienstleistung für Nutzer im Vordergrund, nicht "Organisation der Technik" - Abnehmende Bedeutung an konsortialen Blockchains angenommen
Anonym 30	Research	Nur bedingt Einfluss	1	Wenn es eine Verwaltungsleistung ist, ist der Staat zentraler Quell des Vertrauens. Ein Konsortium mag bei der Nutzerakzeptanz helfen, kann aber auch misstrauisch machen.	- Beteiligungsstruktur relevant für Vertrauen der Nutzer
Anonym 91	Research	Etwas Einfluss	2		
Anonym 41	Research	Etwas Einfluss	2		

A4.1 Blockchain project overview

Last update: October 2019

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
1	Argentina	Boletín Oficial de la República Argentina	Open Meeting Timestamps	Public Records, Compliance/ Reporting	Government Services	No	No	difficult political/societal situation	In-Production/Live
2	Argentina	National Investment & Trade Promotion Agency	Blockchain Center of Excellence	Economic Development	Government Services, Technology & IoT	No	No	difficult political/societal situation	Strategy Announced
3	Australia	Australia Post	Digital Identity	Identity (Credentials/ Licenses/ Attestations)	Government Services	Yes	No	Digital ID concept implemented; customer interaction in scope; mature project status	In-Production / Live
4	Australia	Australia Post	Blockchain-Based Voting	Voting/Elections	Government Services	No	No	No project	Project Incubation
5	Australia	Data61 and CSIRO	Data Monetization	Data Marketplace/ Data Monetization	Technology & IoT	No	No	Research only; no government process implementation	Early Research
6	Australia	Australia Standards	Roadmap for Blockchain Standards	Research/ Standards	Other	No	No	Standards only; no actual process implementation	Strategy Announced
7	Australia	Australia National Transportation Commission	Land Transport Regulation 2040	Public Transportation	Transportation, Technology & IoT	No	No	Research only	Early Research,Strategy Announced
8	Australia	Reserve Bank of Australia	Developments in Financial System Architecture	Digital Currency (Central Bank Issued), Compliance/ Reporting	Government Services, Financial Services	No	No	Research only	Early Research

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
9	Australia	Data61 and CSIRO	Long Term Scenarios and Technical Applications	Strategy/ Research	Technology & IoT, Government Services, Supply Chain	No	No	Research only	Early Research
10	Australia	City of Melbourne	Parking Entitlements Marketplace	Data Marketplace/ Data Monetization	Government Services	No	No	Project status unknown	Testing phase in 2017; status of testing unknown
11	Australia	University of Melbourne	Academic Credentials	"Personal Records (Health, Financial, etc.)", Identity (Credentials/ Licenses/ Attestations)	Government Services, Education	Yes	No	Wider roll-out was considered for 2018; project status not fully known to date	In-Production / Live
12	Australia	Queensland Treasury Corporation	Government Bonds	Financial Services/ Market Infrastructure	Government Services, Financial Services	No	No	No government process implementation	Proof-of-Concept,Project Incubation
13	Australia	RegHack DownUnder	Regulatory Hackathon	Economic Development	Government Services, Energy, Financial Services	No	No	No project	Funding Competition/Research Contest
14	Australia	Australian Parliament	Parliamentary Friends of Blockchain	Economic Development	Government Services	No	No	No project	Strategy Announced,Early Research
15	Australia	Australia DPMC - City of Fremantle	Blockchain-Powered Distributed Energy and Water Systems	Public Utilities	Government Services, Energy	Yes	No	Project status unknown	Testing phase started in 2017
16	Austria	Ministry of Science, Research and Economy	Research Institute for Future Cryptoeconomics	Strategy/ Research, Research/ Standards	Government Services, Education	No	No	No project	Early Research
17	Barbados	Barbados Central Bank	Central Bank Digital Currency	Digital Currency (Central Bank Issued)	Financial Services	No	No	No government process implementation	In-Production/Live

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
18	Belgium	Antwerp Port Authority	Blockchain-based System for Port Container Release	Supply Chain Management/ Trade, Public Transportation	Supply Chain, Transportation	Yes	No	Solution includes multiple stakeholders participating in that process, i.e., mature use case; prodcution planned for end of 2017	Testing phase in 2017
19	Brazil	Cartório de Registro de Imóveis	Land Title Registry	Land Title Registry	Real Estate, Government Services	Yes	No	Although rather small PoC, case seems to be support classical BC scenario	Project Incubation,Proof-of-Concept
20	Brazil	Ministry of Planning, Budget and Management	Blockchain-based Digital Identity	Identity (Credentials/ Licenses/ Attestations)	Government Services	Yes	No	PoC completed, but no further information on next steps available	Proof-of-Concept
21	Cambodia	Cambodian Central Bank	Interbank Payments	Payments/ Financial Infrastructure, Digital Currency (Central Bank Issued)	Financial Services, Government Services	No	No	Uncertain surrounding conditions	Early Research,Project Incubation
22	Canada	Bank of Canada	Project Jasper: Canadian Digital Currency	Digital Currency (Central Bank Issued)	Government Services, Financial Services	No	No	Currency only	Project in Development
23	Canada	Ontario Securities Commission	RegTech Hackathon	Regulatory	Government Services, Financial Services	No	No	No government process implementation	Proof-of-Concept
24	Canada	Department of Innovation, Science and Economic Development	The Blockchain Corridor Report	Strategy/ Research	Government Services, Education, Technology & IoT	No	No	Report only	Strategy Announced
25	Canada	DIACC & Province of British Columbia	Blockchain-based Corporate Registries	Public Records, Business Formation/ Licensing	Government Services	No	No	No government process implementation	Proof-of-Concept, In-Production/Live

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
26	Canada	Province of Ontario	Blockchain Research Institute	Strategy/ Research	Transportation, Energy, Government Services, Healthcare, Financial Services, Real Estate, Telecom, Supply Chain	No	No	Research only	Project in Development
27	Canada	Province of British Columbia	Verified Organization Network (VON)	Business Formation/ Licensing, Identity (Credentials/ Licenses/ Attestations)	Government Services	Yes	No	Public Beta with OrgBook available	In-Production / Live
28	Canada	City of Toronto	Blockchain Research Institute	Strategy/Research	Transportation, Energy, Government Services, Healthcare, Financial Services, Real Estate, Telecom, Supply Chain	No	No	No project	Project in Development
29	Canada	Province of British Columbia: Land Title and Survey Authority	BC Land Titles and Survey Authority's Design Challenge	Land Title Registry	Real Estate, Government Services	No	No	No project	Funding Competition/Research Contest
30	Chile	Commune of Maipú	Blockchain-based Voting	Voting/ Elections	Government Services	No	No		In-Production/Live
31	China	Guiyang Province	Blockchain in Government White Paper	Strategy/ Research	Government Services	No	No	Uncertain surrounding conditions	Strategy Announced,Early Research
32	China	Jiangsu Province	Jiangsu Huaxin Blockchain Research Institute	Strategy/Research	Government Services, Other, Education	No	No	Uncertain surrounding conditions	Early Research,Strategy Announced
33	China	People's Bank of China	Digital Currency Trial	Digital Currency (Central Bank Issued)	Financial Services, Government Services	No	No	Currency only	Early Research,Proof-of-Concept
34	China	Ministry of Industry and Information Technology	National Blockchain Strategy	Strategy/ Research	Government Services	No	No	Uncertain surrounding conditions	Strategy Announced,Early Research

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
35	China	National Council for Social Security Fund	Blockchain-based Social Security Fund	Benefits/ Entitlements, Strategy/ Research	Government Services	No	No	Uncertain surrounding conditions	Early Research
36	China	Chan Cheng District	Intelligent Multifunctional Identity (IMI)	"Personal Records (Health, Financial, etc.)", Identity (Credentials/ Licenses/ Attestations)	Government Services	No	No	Uncertain surrounding conditions	Project Incubation,Proof-of-Concept,Project in Development
37	China	People's Bank of China	Central Bank Digital Currency	Digital Currency (Central Bank Issued)	Government Services, Financial Services	No	No	Currency only	Proof-of-Concept,Project Incubation,Project in Development
38	China	Miaocai Network	Blockchain Based-Tax Collection System	Tax Collection/ Credits	Government Services	No	No	Uncertain surrounding conditions	Project Incubation,Proof-of-Concept
39	Denmark	Liberal Alliance Party	Blockchain-based Party Voting	Voting/ Elections	Government Services	No	No	Low public service complexity	Early Research,Strategy Announced
40	Denmark	Danmarks Nationalbank	E-Krone Project	Digital Currency (Central Bank Issued)	Government Services, Financial Services	No	No	Currency only	Early Research
41	Denmark	Ministry of Foreign Affairs of Denmark	Denmark at the digital forefront - Technology in Development	Strategy/ Research	Government Services	No	No	No project	Early Research,Research Paper
42	Estonia	E-Estonia, E-Governance	i-Voting	Voting/ Elections	Government Services	No	No	Low public service complexity	In-Production/Live
43	Estonia	E-Estonia	Blockchain-based Keyless Signature Infrastructure (KSI)	Cybersecurity (Critical Infrastructure)	Government Services	No	No	infrastructure only	In-Production/Live
44	Estonia	E-Estonia	X-Road Interoperability Services	"Personal Records (Health, Financial, etc.)"	Government Services	Yes	No	Fits to citizen-centred approach	In-Production / Live

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
45	Estonia	Estonian e-Health Records	Health Records	"Personal Records (Health, Financial, etc.)"	Government Services, Healthcare	Yes	No	Fits to citizen-centred approach	In-Production / Live
46	Estonia	E-Estonia	Estcoin	Digital Token	Government Services, Financial Services	No	No	Currency only	Early Research
47	Finland	City of Kouvola	SmartLog: Blockchain-based Supply Chain Tracking	Supply Chain Management/ Trade, Supply Chain/ Manufacturing	Government Services, Supply Chain	Yes	No	Proof-of-Concept only, but project considers various public and private players	Project Incubation,Project in Development
48	France	France Stratégie	Blockchain Research Study	Strategy/ Research, Research/ Standards, Economic Development	Government Services	No	No	No project	Early Research,Strategy Announced
49	France	Banque de France	SEPA Credit Identifier Management	Financial Services/ Market Infrastructure	Government Services, Financial Services	No	No	No project information available	Early Research,Proof-of-Concept
50	Germany	German Parliament	Blockchain Bundesverband	Research/ Standards	Government Services	No	No	No project	Strategy Announced
51	Ghana	Ministry of Lands and Natural Resources	Land Registry	Land Title Registry	Financial Services, Government Services, Real Estate	No	No	MoU between Ghana and IBM in 2018; no further information on status available	Early Research
52	Honduras	El Registro de la Propiedad Inmueble	Blockchain-based Land Titling System	Land Title Registry	Real Estate	No	No	Decommissioned	Decommissioned/Stopped
53	Hong Kong	Hong Kong Monetary Authority	Digital Identity POC	Identity (Credentials/ Licenses/ Attestations), "Personal Records (Health, Financial, etc.)"	Financial Services, Government Services	No	No	No project information available	Early Research,Project Incubation,Proof-of-Concept,Research Paper
54	Hong Kong	Hong Kong Monetary Authority	Trade Finance	Financial Services/ Market Infrastructure, Supply Chain Management/ Trade	Financial Services, Government Services, Supply Chain, Industrial/ Manufacturing	Yes	No	Company-focused approach; live since September 2018	In-Production/Live,Research Paper

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
55	Hong Kong	Hong Kong Monetary Authority	Mortgage Loan Application POC	Land Title Registry, Compliance/ Reporting	Financial Services, Government Services, Real Estate	No	No	Research only; prototype only	Early Research,Project Incubation,Proof-of-Concept,Research Paper
56	Hong Kong	Hong Kong Monetary Authority	Central Bank Digital Currency	Digital Currency (Central Bank Issued)	Financial Services,Government Services	No	No	Currency only	Early Research,Project Incubation
57	Hong Kong	Hong Kong Financial Services Development Council	Hong Kong – Building Trust Using Distributed Ledger Technology	Strategy/ Research	Financial Services, Government Services	No	No	No project	Strategy Announced,Research Paper
58	India	State of Andhra Pradesh	Blockchain-based Land Title Registry	Land Title Registry	Financial Services, Real Estate, Government Services	No	No	No government process implementation; announcement of project only	Project Incubation,Project in Development
59	India	Institute for Development and Research in Banking Technology (IDRBT)	Applications of Blockchain Technology to Banking and Financial Sector in India	Strategy/ Research	Government Services, Financial Services	No	No	No project	Research Paper
60	India	State of Andhra Pradesh: Electronics & Information Technology Agency	Blockchain Research Institute	Research/ Standards, Economic Development	Technology & IoT	No	No	No government process implementation	Strategy Announced
61	India	State of Telangana, Centre for Development of Advanced Computing (C-DAC)	Blockchain-based Land Title Registry	Land Title Registry	Government Services, Real Estate	No	No	No government process implementation	Project Incubation,Proof-of-Concept

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
62	India	State of Andhra Pradesh	Civil Supplies Registry	Benefits/Entitlements	Government Services	No	No	No government process implementation	Project Incubation,Project in Development
63	India	Institute for Development and Research in Banking Technology (IDRBT)	Trade Finance Proof of Concept	Financial Services/ Market Infrastructure, Supply Chain Management/ Trade	Financial Services, Government Services	No	No	No project update available	Proof-of-Concept
64	India	State of Andhra Pradesh	Enterprise Ethereum Alliance Membership	Research/ Standards	Technology & IoT, Government Services	No	No	No project	Strategy Announced
65	Israel	Bank of Israel, Ministry of Finance	Digital Shekel	Digital Currency (Central Bank Issued)	Government Services, Financial Services	No	No	Currency only	Early Research
66	Japan	Ministry of Economy, Trade and Industry	Blockchain Assessment Methodology	Strategy/ Research	Government Services	No	No	Research only	Research Paper
67	Japan	Ministry of Economy, Trade and Industry	Survey on Blockchain Technologies and Related Services	Strategy/ Research	Government Services, Technology & IoT	No	No	Research only	Research Paper
68	Japan	Ministry of Justice	Blockchain-based Land Registry	Land Title Registry	Government Services, Real Estate	No	No	No project update available	Strategy Announced,Project Incubation
69	Japan	Ministry of Internal Affairs and Communications	Blockchain-Based Tendering System	Purchasing/ Procurement/ Contracting	Government Services	No	No	No project update available	Strategy Announced,Project Incubation
70	Kazakhstan	National Bank of Kazakhstan	Short Term Debt Note Issuance	Payments/ Financial Infrastructure	Financial Services, Government Services	No	No	Currency only	Project Incubation,Proof-of-Concept
71	Kenya	Ministry of Information Communication	Academic Credentials	"Personal Records (Health, Financial, etc.)", Identity (Credentials/ Licenses/ Attestations)	Education, Healthcare, Government Services, Real Estate	Yes	No	Proven use case; no progress could be identified	Proof-of-Concept,Project in Development

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
72	Kenya	Public Debt Management Office	Blockchain-Based Bond Trials	Asset Registry, Financial Services/ Market Infrastructure	Financial Services, Government Services	No	No	Currency only	Early Research,Project in Development
73	Luxembourg	State of Luxembourg	Infrachain	New Products/ Services, General Infrastructure	Government Services, Financial Services, Technology & IoT, Telecom	Yes	No	Government involved and approach is promissing; but no actual public service (ID service maybe) identified	Strategy Announced,Early Research,Project Incubation
74	Luxembourg	LuxTrust	Privacy Protecting Identity Platform	New Products/ Services, Identity (Credentials/ Licenses/ Attestations) , Cybersecurity (Critical Infrastructure)	Government Services, Technology & IoT, Financial Services, Healthcare	No	No	Incorporated in Infrachain	Strategy Announced,Project in Development
75	Malta	Prime Minister of Malta	Blockchain Strategy	Strategy/ Research	Government Services	No	No	No project	Strategy Announced
76	Malta	Ministry for Education and Employment	Educational & Government Digital Certificates	Identity (Credentials/ Licenses/ Attestations), "Personal Records (Health, Financial, etc.)"	Government Services, Education	Yes	Yes	Pilot completed, now building up public service; project is still running	Project in Development
77	Mauritius	Board of Investment, Bank of Mauritius	Government Blockchain Strategy	Strategy/ Research, Economic Development	Government Services	No	No	No government process implementation	Strategy Announced
78	Mexico	Ministry of Economy - Commercial Regulation Unit	Digital Bonds Platform	Financial Services/ Market Infrastructure	Government Services, Financial Services	No	No	Currency only	Early Research
79	Netherlands	Ministry of Interior Affairs	Digital Identity	Identity (Credentials/ Licenses/ Attestations), "Personal Records (Health, Financial, etc.)"	Government Services, Financial Services, Healthcare, Technology & IoT	No	No	Part of Dutch Blockchain Coalition (see below)	Early Research,Project Incubation,Proof-of-Concept
80	Netherlands	Ministry of Justice	Execution of a judicial decision of juvenile court	Law Enforcement, Law/ Legal Enforcement/ Courts	Government Services	No	No	Part of Dutch Blockchain Coalition (see below)	Early Research,Project Incubation,Proof-of-Concept

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
81	Netherlands	Court of Audit	Audit and Accounting Compliance	Government Finance	Government Services	No	No	Part of Dutch Blockchain Coalition (see below)	Early Research
82	Netherlands	Human Environment and Transport Inspectorate	Toxic Waste Transport	Compliance/ Reporting, Regulatory	Government Services, Energy	Yes	No	Planned to implement prototype, as of December 2018.	Early Research,Project Incubation,Proof-of-Concept
83	Netherlands	Human Environment and Transport Inspectorate	Truck Driver Tracking	Compliance/ Reporting, Public Transportation	Government Services, Transportation	No	No	No information on status available	Project Incubation,Proof-of-Concept
84	Netherlands	Ministry of Finance	Financing New School Buildings	Government Finance, Land Title Registry	Government Services, Financial Services	No	No	No information on status available	Project Incubation,Proof-of-Concept
85	Netherlands	City of the Hague	Electric Vehicle Subsidy Registry	Tax Collection/ Credits, Purchasing/ Procurement/ Contracting	Government Services, Transportation, Energy	No	No	No information on status available	Project Incubation,Proof-of-Concept
86	Netherlands	CAK	Public Healthcare Benefits Subsidy	"Personal Records (Health, Financial, etc.)", Benefits/ Entitlements	Government Services, Healthcare	No	No	No information on status available	Project Incubation,Proof-of-Concept
87	Netherlands	CIBG	Medical Instrument Registration	Compliance/ Reporting, Identity (Credentials/ Licenses/ Attestations)	Government Services, Healthcare	No	No	No information on status available	Project Incubation,Proof-of-Concept
88	Netherlands	The Inspectorate of the Ministry of Employment	Employment and Identity Fraud	Benefits/ Entitlements, "Personal Records (Health, Financial, etc.)"	Government Services	No	No	No information on status available	Project Incubation,Proof-of-Concept
89	Netherlands	Ministry of Foreign Affairs	Multi-stakeholder Financial Arrangements	Government Finance	Government Services	No	No	No information on status available	Project Incubation,Proof-of-Concept
90	Netherlands	Healthcare Institute	Healthcare Process Authorization	Identity (Credentials/ Licenses/ Attestations), "Personal Records (Health, Financial, etc.)"	Government Services, Healthcare	No	No	No relevant public service in scope	Project Incubation,Proof-of-Concept
91	Netherlands	Province of Noord-Brabant	Subsidy Process Optimization	Compliance/ Reporting, Benefits/ Entitlements	Government Services	No	No	No project	Early Research

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
92	Netherlands	Chamber of Commerce	FlashCompany	Economic Development	Government Services	No	No	No government process implementation	Early Research,Project Incubation,Proof-of-Concept
93	Netherlands	Kadaster: Land Registry and Mapping Agency	Ship Registration	Compliance/ Reporting, Identity (Credentials/ Licenses/ Attestations), Public Transportation	Government Services, Transportation	No	No	Research only	Early Research,Project Incubation
94	Netherlands	Legal Aid Board	Improving Requests for Legal Aid	Law/ Legal Enforcement/ Courts	Government Services	No	No	No information on status available	Early Research
95	Netherlands	Tax and Customs Administration	Smarter Tax Revenues	Compliance/ Reporting, Tax Collection/ Credits	Government Services	No	No	No information on status available	Early Research
96	Netherlands	Gemeente Amsterdam	Personal Healthcare Budgets	Benefits/Entitlements, "Personal Records (Health, Financial, etc.)"	Government Services	Yes	No	Pilot project on municipality level	Early Research,Project Incubation
97	Netherlands	Gemeente Stichtse Vecht	Requesting Medical Devices	Benefits/Entitlements, "Personal Records (Health, Financial, etc.)"	Government Services, Healthcare	No	No	No detailed information on project status available	Project Incubation,Proof-of-Concept
98	Netherlands	Gemeente Rotterdam	Tourist Tax Collection	Tax Collection/ Credits	Government Services, Recreation & Tourism	No	No	Use case definition only	Early Research,Project Incubation
99	Netherlands	Ministry of Justice	Criminal Trial Information Sharing	Law Enforcement, Law/ Legal Enforcement/ Courts	Government Services	No	No	Use case definition only	Early Research,Project Incubation
100	Netherlands	Gemeente Schiedam	Blockchain for Government Finance	Compliance/ Reporting, Government Finance, Purchasing/ Procurement/ Contracting	Government Services	No	No	No information on status available	Project Incubation,Proof-of-Concept
101	Netherlands	Gemeente Schiedam	Blockchain-based Debt Counseling System	Benefits/ Entitlements, New Products/ Services, Compliance/ Reporting	Government Services, Financial Services	No	No	No information on status available	Project Incubation,Proof-of-Concept
102	Netherlands	Gemeente Schiedam & Drechtsteden	Parking Spaces for Disabled Citizens	Benefits/ Entitlements, Public Transportation	Government Services, Healthcare	Yes	No	Proof-of-concept phase with mature process definitions	Project Incubation,Proof-of-Concept

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
103	Netherlands	Dutch Blockchain Coalition	Self-Souvereign Identity (e.g. for age control)		Government Services	Yes	No	Use case definitions in line with this article's research objective	Proof-of-Concept completed
104	Netherlands	Dutch Blockchain Coalition	Educational certificates and diplomas		Government Services	Yes	No	Proven use case; "has been tested on small scale"	Proof-of-Concept completed
105	Netherlands	BAR Organization, Gemeente Barendrecht, Gemeente Albrandswaard, Gemeente Ridderkerk	Large Event Permitting	Identity (Credentials/ Licenses/ Attestations)	Government Services	Yes	No	Multiple stakeholders involved for the process in scope of this project	Pilot project
106	Netherlands	Gemeente Utrecht	Waste Sector Data Sharing	Data Marketplace/ Data Monetization, Public Utilities	Government Services, Energy	Yes	No	Pilot project on municipality level	Pilot project
107	Netherlands	Gemeente Zuidhorn	Aid Subsidy Collection	Benefits/ Entitlements	Government Services	Yes	No	Rather mature blockchain implementation; won a price for this blockchain solution in 2018	Proof-of-Concept,Project in Development
108	Netherlands	Dutch Blockchain Hackathon	Blockchain Hackthon	Economic Development	Government Services	No	No	No project	Funding Competition/Research Contest
109	Netherlands	Rijksdienst voor Identiteitsgegevens (RvIG), Gemeente Zaanstad	Blockchain-based Digital Identity: Do-it-Yourself Marriage	Identity (Credentials/ Licenses/ Attestations), "Personal Records (Health, Financial, etc.)"	Government Services	No	No	No information on status available	Early Research,Proof-of-Concept
110	Netherlands	Kadaster, Gemeente Eindhoven	Blockchain-based Land Registry	Land Title Registry	Government Services, Real Estate	No	No	No information on status available	Early Research,Proof-of-Concept
111	Netherlands	Port of Rotterdam, Gemeente Rotterdam	BlockLab - Blockchain Research Lab	Economic Development, Strategy/ Research	Supply Chain, Transportation	No	No	No project	Strategy Announced

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
112	Netherlands	Port of Rotterdam	The Blockchain Potential for Port Logistics	Strategy/ Research	Supply Chain, Transportation	No	No	No project	Research Paper
113	Netherlands	Port of Rotterdam	DELIVER	Supply chain, logistics	Supply Chain, Transportation	Yes	No	End-to-end project; "The first paperless, instantly financed and fully door-to-door tracked container shipped"	In-Production/Live
114	Norway	Norwegian Centre for E-Health Research	Healthcare DLT Research & Innovation Network	"Personal Records (Health, Financial, etc.)", Identity (Credentials/ Licenses/ Attestations)	Healthcare	No	No	No project	Early Research
115	Norway	Norwegian Local Governments	Loyalty Rewards for Local Governments	Loyalty Rewards	Government Services, Retail & Consumer Goods	No	No	No relevant public service in scope	Early Research,Project in Development
116	Palestine	Palestine Monetary Authority (PMA)	Palestinian e-Currency	Digital Currency (Central Bank Issued), Payments/ Financial Infrastructure	Financial Services, Government Services	No	No	Currency only	Early Research
117	Papua New Guinea	Bank of Papua New Guinea	Blockchain Research Strategy	Digital Currency (Central Bank Issued), Strategy/ Research	Government Services, Financial Services	No	No	No project	Early Research,Strategy Announced
118	Republic of Georgia	National Agency of Public Registry	Blockchain-based Land Title System	Land Title Registry	Real Estate, Government Services, Financial Services	Yes	No	Maturity of blockchain solution; "In 2018, Georgia registered over 1.5 million land titles on their blockchain-based system"	In-Production/Live
119	Russia	Federal Antimonopoly Service	Digital Ecosystem Pilot Project	Public Records, General Infrastructure	Government Services, Media & Rights Ownership	No	No	Uncertain surrounding conditions	Early Research,Strategy Announced

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
120	Russia	National Settlement Depository	Blockchain-based Voting	Voting/Elections, Financial Services/Market Infrastructure	Financial Services	No	No	Uncertain surrounding conditions	Proof-of-Concept,Project in Development
121	Russia	Central Bank of Russia	Masterchain	"Personal Records (Health, Financial, etc.)", Financial Services/Market Infrastructure, Payments/ Financial Infrastructure	Financial Services	No	No	Uncertain surrounding conditions	Proof-of-Concept,Project in Development
122	Russia	Central Bank of Russia	Fintech Association	"Personal Records (Health, Financial, etc.)", Financial Services/ Market Infrastructure, Payments/ Financial Infrastructure	Financial Services	No	No	Uncertain surrounding conditions	Strategy Announced,Project in Development
123	Russia	Central Bank of Russia	Central Bank Digital Currency	Digital Currency (Central Bank Issued)	Financial Services, Government Services	No	No	Currency only	Early Research,Project Incubation,Project in Development
124	Russia	Ministry of Economic Development, the Federal Service for State Registration, Cadastre and Cartography (Rosreetr), the Federal Tax Service and the Government of Moscow	Land Title Registration	Land Title Registry	Government Services, Real Estate	No	No	Uncertain surrounding conditions	Early Research,Proof-of-Concept
125	Russia	National Settlement Depository	Issuance of Commercial Paper	Financial Services/ Market Infrastructure	Financial Services	No	No	Uncertain surrounding conditions	Project in Development,In-Production/Live
126	Russia	Vnesheconombank (VEB)	e-Procurement Resource Platform	Purchasing/ Procurement/ Contracting	Financial Services	No	No	Uncertain surrounding conditions	Early Research
127	Russia	Vnesheconombank (VEB)	Ethereum Partnership	Strategy/ Research	Financial Services	No	No	Uncertain surrounding conditions	Strategy Announced
128	Russia	Vnesheconombank (VEB), MISiS National	Blockchain Center of Competence	Economic Development, Strategy/ Research	Government Services, Financial Services	No	No	Uncertain surrounding conditions	Strategy Announced

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
		University of Science and Technology							
129	Russia	National Settlement Depository	Cryptocurrency Wallet & Digital Asset Platform	Asset Registry, Financial Services/ Market Infrastructure	Financial Services	No	No	Currency only	Project in Development
130	Russia	Ministry of Health, Vnesheconombank (VEB)	Blockchain Applications in Public Health	Strategy/ Research, "Personal Records (Health, Financial, etc.)"	Government Services, Healthcare	No	No	Uncertain surrounding conditions	Strategy Announced
131	Russia	National Settlement Depository	Blockchain Assets Circulation	Asset Registry, Financial Services/ Market Infrastructure	Financial Services	No	No	Uncertain surrounding conditions	Proof-of-Concept
132	Senegal	Central Bank of the West African Economic and Monetary Union (WAEMU)	eCFA Digital Currency	Digital Currency (Central Bank Issued)	Government Services, Financial Services	No	No	Currency only	In-Production/Live
133	Singapore	Monetary Authority of Singapore (MAS)	Project Ubin	Financial Services/ Market Infrastructure	Financial Services, Government Services	No	No	Currency only	Proof-of-Concept,Project in Development
134	Singapore	Government Technology Agency; Ministry of Education	OpenCerts, Digital certificates for education	Education		Yes	No	Actual process since 2019	In-Production/Live
135	Singapore	Info-communications and Media Development Authority (IMDA)	Trade Finance	Financial Services/ Market Infrastructure, Supply Chain Management/ Trade	Financial Services, Supply Chain, Government Services	No	No	No project information available	Proof-of-Concept
136	Singapore	Singapore Economic Development Board, Monetary Authority of Singapore (MAS)	IBM Blockchain Innovation Centre	Economic Development	Financial Services, Supply Chain, Government Services	No	No	No project	Project in Development

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
137	Singapore	Monetary Authority of Singapore (MAS)	R3 Blockchain Centre of Excellence	Economic Development	Financial Services, Government Services	No	No	No project	Project in Development
138	Singapore	Info-Communications and Media Development Authority (IMDA)	Hackathon Competition: Securing IoT Devices with Blockchain	Economic Development	Government Services, Technology & IoT	No	No	No project	Proof-of-Concept,Early Research
139	South Africa	South African Reserve Bank (SARB)	Financial Services Consortium: Syndicated Loans	Research/ Standards, Financial Services/ Market Infrastructure	Government Services, Financial Services	No	No	Currency only	Early Research,Project in Development
140	South Korea	South Korea Central Bank	Cryptocurrency Economy	Digital Currency (Central Bank Issued)	Financial Services, Government Services	No	No	Currency only	Early Research
141	South Korea	Gyeonggi-do Province	Local Government Voting	Voting/ Elections	Government Services	No	No	No relevant public service in scope	In-Production/Live
142	South Korea	Seoul Metropolitan Government	Blockchain Strategy Research	Strategy/ Research	Government Services	No	No	No project	Early Research
143	Sweden	Lantmäteriet	Blockchain Land Registry	Land Title Registry	Government Services, Real Estate, Financial Services	Yes	Yes	First transaction was planned in March 2018	Project in Development,Proof-of-Concept
144	Sweden	Sveriges Riksbank	E-Krona Project	Digital Currency (Central Bank Issued)	Government Services, Financial Services	No	No	No project	Project in Development,Research Paper
145	Sweden	Vattenfall - Business Area Markets	Decentralized Energy Trading Marketplace	Public Utilities, Data Marketplace/ Data Monetization	Energy	No	No	No relevant public service in scope	Proof-of-Concept,Project Incubation
146	Switzerland	Canton of Zug	Blockchain-based Digital ID Verification	"Personal Records (Health, Financial, etc.)", Identity (Credentials/ Licenses/ Attestations)	Government Services, Technology & IoT	Yes	Yes	Government process implementation using eID	In-Production/Live
147	Switzerland	Canton of Schaffhausen	e-Government Pilot Project	"Personal Records (Health, Financial, etc.)", Identity	Government Services, Technology & IoT	Yes	No	Government process	In-Production/Live

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
				(Credentials/ Licenses/ Attestations)				implementation using Digital ID	
148	Switzerland	Swiss Federal Government	Swiss Cryptovalley	Economic Development	Financial Services, Technology & IoT	No	No	No government process implementation	Strategy Announced
149	Switzerland	Swisscom AG	Swisscom AG Hyperledger Membership	Research/ Standards	Technology & IoT, Telecom	No	No	No relevant public service in scope	Strategy Announced
150	Switzerland	Commission for Technology and Innovation (CTI)	OTC Swiss Blockchain	Financial Services/ Market Infrastructure	Financial Services	No	No	Project decommissioned	Decommissioned
151	Switzerland	Canton of Zug	E-Voting	Voting/ Elections		No	No	Low public service complexity	Project in Development
152	Thailand	Thailand Post, State Railway of Thailand	Blockchain and IoT for Railway Logistics	Public Transportation, Supply Chain Management/Trade	Transportation, Supply Chain	No	No	Status unknown	Early Research,Project Incubation
153	Tunisia	La Poste Tunisienne	eDinar Digital Currency	Digital Currency (Central Bank Issued)	Government Services, Financial Services	No	No	Currency only	In-Production/Live
154	Uganda	National Drug Authority	Verify distribution of counterfeit drugs	Not found	Government Services	No	No	Government support declared in July 2019. No mature project results.	Project Incubation,Project in Development
155	Ukraine	Ministry of Finance	e-Auction 3.0	Asset Registry, Data Marketplace/ Data Monetization, Land Title Registry	Government Services, Real Estate, Financial Services, Supply Chain	No	No	No solution/project information available; no English version available	In-Production/Live
156	Ukraine	State Land Cadastre	Blockchain Based Land Title System	Land Title Registry	Government Services, Real Estate	Yes	No	Mature project status	In-Production/Live

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
157	Ukraine	State Agency for e-Government	Blockchain e-Governance Platform	Asset Registry, Benefits/ Entitlements, Identity (Credentials/ Licenses/ Attestations), Land Title Registry	Government Services, Real Estate, Healthcare, Energy, Financial Services	No	No	No project update available	Strategy Announced
158	Ukraine	State Agency for e-Government	Real Estate Investment Listing Service	Asset Registry, New Products/ Services	Government Services, Real Estate	No	No	No english version available	Strategy Announced
159	United Arab Emirates	Smart Dubai Office	Dubai Blockchain Strategy	Strategy/ Research	Government Services, Technology & IoT	No	No	No project	Strategy Announced,Project in Development,Project Incubation
160	United Arab Emirates	Dubai Customs, Dubai Trade	Not found	Supply Chain Management/ Trade, Regulatory	Government Services, Supply Chain, Financial Services	No	No	No project update available	Project in Development
161	United Arab Emirates	Dubai Immigration and Visas Department	Not found	Multiple	Government Services	Yes	No	Various implementations planned according to Strategy 2020; however, detailed information on implementations not available	/
162	United Arab Emirates	Dubai Future Foundation	Global Blockchain Council	Strategy/ Research, Economic Development	Government Services, Healthcare, Supply Chain, Technology & IoT, Transportation, Other	No	No	No project	Strategy Announced,Project Incubation
163	United Arab Emirates	Smart Dubai Office	Global Blockchain Challenge	Economic Development	Energy, Government Services, Healthcare, Technology & IoT, Supply Chain	No	No	No government process implementation	Strategy Announced
164	United Arab Emirates	Du, NMC Healthcare	Health Records	"Personal Records (Health, Financial, etc.)"	Healthcare	No	No	No project update available	Strategy Announced,Project Incubation

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
165	United Arab Emirates	Dubai Multi Commodities Centre	Securing the Diamond Trade	Supply Chain Management/ Trade	Supply Chain	No	No	No project update available	Strategy Announced,Proof-of-Concept,Project in Development
166	United Arab Emirates	Smart Dubai	Government Shared Services	General Infrastructure	Government Services	No	No	No project	Request for Proposal/Bid
167	United Kingdom	Government Office for Science	Distributed ledger technology: beyond block chain	Strategy/ Research, Economic Development	Government Services, Technology & IoT	No	No	No project	Early Research,Strategy Announced
168	United Kingdom	Financial Conduct Authority (FCA)	Discussion Paper on distributed ledger technology	Strategy/ Research, Research/ Standards	Government Services, Financial Services	No	No	No project	Early Research,RFI/Call for Input
169	United Kingdom	Innovate UK	Funding Competition: Emerging and Enabling Technologies	Economic Development	Technology & IoT	No	No	No project	Funding Competition/Research Contest
170	United Kingdom	Department of Work and Pensions	GovCoin Proof of Concept	Benefits/ Entitlements	Government Services	No	No	Project decommissioned	Decommissioned
171	United Kingdom	HM Land Registry	Digital Street	Strategy/ Research, Land Title Registry	Government Services, Real Estate	Yes	No	Process analysis conducted according to gov. entity; developed "working prototypes"	Early Research
172	United Kingdom	The Royal Mint	RMG® The New Digital Gold Standard	Financial Services/ Market Infrastructure, New Products/ Services	Government Services, Financial Services	No	No	Currency only	Project in Development,In-Production/Live
173	United Kingdom	Bank of England	FinTech Accelerator Proof of Concept:	Digital Currency (Central Bank Issued), Land Title Registry	Government Services, Financial Services	No	No	Currency only	Project Incubation,Proof-of-Concept

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
			Distributed Ledger Technology						
174	United Kingdom	Bank of England	The macroeconomics of central bank issued digital currencies	Financial Services/Market Infrastructure, Strategy/ Research, Digital Currency (Central Bank Issued)	Government Services, Financial Services	No	No	Currency only	Early Research,Project in Development
175	United Kingdom	Isle of Man	Securing the Internet of Things	Internet of Things, Cybersecurity (Critical Infrastructure)	Government Services, Technology & IoT	No	No	Project decommissioned	Decommissioned/Stopped
176	United Kingdom	Isle of Man	Digital Currency Business Register	Public Records	Government Services	No	No	No government process implementation	Proof-of-Concept
177	United Kingdom	Isle of Man	Protect thriving e-gaming sector from fraud	Financial Services	Government Services	No	No	Regulation for e-lottery (e.g. Quanta) only	In-Production/Live
178	United Kingdom	House of Lords	Distributed Ledger Technologies for Public Good: Leadership, Collaboration and Innovation	Strategy/ Research	Government Services, Healthcare, Transportation, Technology & IoT, Supply Chain, Financial Services	No	No	Research only	Research Paper
179	United Kingdom	Bank of England	Distributed Ledger-based Gross Settlement System	Financial Services/ Market Infrastructure	Government Services, Financial Services	No	No	Currency only	Project in Development
180	United Kingdom	Engineering and Physical Sciences Research Council (EPSRC)	Distributed Ledger Technology (DLT) in Energy, Healthcare, Banking and Policy-Making	Strategy/ Research	Government Services, Energy, Healthcare, Financial Services	No	No	No project	Early Research,Research Paper

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
181	United Kingdom	Financial Conduct Authority (FCA)	Project Maison	Financial Services/ Market Infrastructure	Government Services, Real Estate, Financial Services	No	No	No government process implementation	Proof-of-Concept
182	United States - Federal	Department of Energy	Small Business Innovation Research (SBIR)	Research/ Standards, Public Utilities	Energy	No	No	Status unknown	RFI/Call for Input
183	United States - Federal	Health and Human Services (HHS) - ONC	Blockchain and Its Emerging Role in Healthcare and Health-related Research	Research/ Standards, "Personal Records (Health, Financial, etc.)"	Government Services, Healthcare	No	No	No project	Funding Competition/Research Contest
184	United States - Federal	Department of Homeland Security (DHS): Science and Technology (S&T) Directorate and the Domestic Nuclear Detection Office (DNDO)	Applicability of Blockchain Technology to Privacy Respecting Identity Management	Research/ Standards, Identity (Credentials/Licenses/Attestations)	Government Services, Technology & IoT	No	No	Status unknown	Early Research,RFI/Call for Input
185	United States - Federal	Federal Reserve Bank	Distributed ledger technology in payments, clearing, and settlement	Strategy/Research, Payments/ Financial Infrastructure	Government Services, Financial Services	No	No	No implementation planned	Early Research
186	United States - Federal	General Services Administration (GSA)	FAStLane Automation RFQ	Purchasing/ Procurement/ Contracting	Government Services	No	No	No government process implementation	Request for Proposal/Bid
187	United States - Federal	Health and Human Services (HHS) - ONC	Blockchain in Healthcare Code-A-Thon	"Personal Records (Health, Financial, etc.)", Benefits/ Entitlements	Government Services, Healthcare	No	No	No government process implementation	Funding Competition/Research Contest
188	United States - Federal	US Food and Drug Administration	Improve security of prescription drug supply and distribution	Supply chain, Personal records	Government Services, Healthcare	Yes	No	Broad stakeholder involvement; The project is scheduled to be	Project in development

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
								completed in the fourth quarter of 2019	
189	United States - Federal	DARPA	Secure Messaging Platform	Strategy/ Research, Military/ Defense Infrastructure	Government Services, Military/ Defense	No	No	No relevant public service in scope	RFI/Call for Input
190	United States - Federal	Department of the Navy	Blockchain to Securely Share Additive Manufacturing	Supply Chain/ Manufacturing, Military/ Defense Infrastructure, Strategy/ Research	Government Services, Military/ Defense	No	No	No relevant public service in scope	Early Research
191	United States - Federal	US Postal Service	Blockchain Technology: Possibilities for the U.S. Postal Service	Supply Chain Management/ Trade, Identity (Credentials/ Licenses/ Attestations)	Government Services, Transportation, Supply Chain	No	No	Research only	Research Paper
192	United States - Federal	General Services Administration (GSA)	Federal Blockchain Forum	Strategy/ Research	Government Services	No	No	No project	Strategy Announced,Project in Development
193	United States - Federal	Institute of Museum and Library Services	Investigation of Possible Uses of Blockchain Technology by Libraries-Information Centers to Support City-Community Goals	Public Records	Government Services	No	No	No project	Early Research,Request for Proposal/Bid
194	United States - State Government	State of Illinois	Vital Records	Identity (Credentials/ Licenses/ Attestations)	Government Services, Healthcare	No	No	Project decommissioned	Early Research,Project Incubation
195	United States - State Government	State of Delaware	Smart UCC Filings	Compliance/ Reporting, Data Marketplace/ Data Monetization	Financial Services, Supply Chain, Retail & Consumer Goods	No	No	No government process implementation	Project Incubation,Project in Development
196	United States - State Government	State of Delaware	Blockchain-based Corporate Shares	New Products/ Services, Regulatory	Government Services, Financial Services	No	No	No government process implementation	Project in Development

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
197	United States - State Government	State of Vermont	Blockchain Research Strategy	Strategy/ Research	Government Services	No	No	Project decommissioned	Decommissioned/Stopped,Early Research
198	United States - State Government	State of Utah: Utah Republican Party	Utah Presidential Caucus 2016: Online Voting	Voting/ Elections	Government Services	No	No	Uncertain surrounding conditions	In-Production/Live
199	United States - State Government	State of Delaware	Blockchain-based Public Archives	General Infrastructure, Public Records	Government Services	No	No	No government process implementation	Project Incubation,Proof-of-Concept,Project in Development
200	United States - State Government	State of Illinois	Renewable Energy Credit Marketplace	New Products/ Services, Public Utilities	Energy, Government Services	No	No	No implementation planned	Early Research,Project Incubation
201	United States - State Government	State of Illinois	Health Provider Registries	Identity (Credentials/ Licenses/ Attestations)	Government Services, Healthcare, Financial Services	No	No	No implementation planned	Early Research,Project Incubation
202	United States - State Government	State of Illinois	Academic Credentialing	"Personal Records (Health, Financial, etc.)", Identity (Credentials/ Licenses/ Attestations)	Government Services, Education	No	No	No implementation planned	Early Research,Project Incubation
203	United States - State Government	Cook County Recorder of Deeds	Land Title Registry	Land Title Registry	Real Estate, Government Services, Financial Services	No	No	Status unknown	Early Research,Project Incubation
204	United States - State Government	State of Illinois	Illinois Blockchain Initiative	Strategy/ Research, Economic Development	Technology & IoT, Government Services	No	No	No government process implementation	Strategy Announced
205	United States - State Government	State of Texas: University of Texas - UTx	Academic Records - ChainScript ™	Identity (Credentials/ Licenses/ Attestations), "Personal Records (Health, Financial, etc.)"	Government Services, Education	No	No	Project status unknown; no update since 2016	Project in Development
206	United States - State Government	State of Illinois	Blockchain Hackathon	Economic Development	Government Services	No	No	No government process implementation	Funding Competition/Research Contest
207	United States - State Government	State of Illinois	Blockchain Legislative Task Force Report	Strategy/ Research	Government Services	No	No	No government process implementation	Research Paper

ID	Country	Government entity	Project Name	Project type	Related industry	Interview candidate? [yes/no]	Interview conducted? [yes/no]	Explanation for candidate selection	Identified project progress as of September 2019
208	United States - State Government	State of Virginia	Blockchain Legislative Study	Strategy/ Research, Economic Development	Government Services	No	No	Study only	Early Research,Research Paper
209	United States - State Government	State of New York	Blockchain Legislative Study	Strategy/ Research, Economic Development	Government Services	No	No	Study only	Early Research,Research Paper
210	United States - State Government	State of Colorado	Blockchain Legislative Study	Strategy/ Research, Economic Development	Government Services, Technology & IoT	No	No	Study only	Early Research,Research Paper
211	Venezuela	Despacho de la Presidencia	Petro-backed Digital Currency	Digital Currency (Central Bank Issued), Digital Token	Government Services, Financial Services	No	No	Currency only	Early Research

A4.2 Interview questionnaire

#	Question	NPG core element	Category of subject	Reference
First, I would like to understand the technical characteristics of your blockchain solution.				
0	Could you please describe your blockchain solution and its purpose?	VCN		
1	Do others need a permission to join your blockchain network?	IOG	Basics	
2	Can others read and write in your blockchain network without a permission, similar to the Bitcoin network?	IOG	Basics	BH19; FM19
3	Is your blockchain storing all the data on-chain or is it only storing transaction data, referencing e.g. to documents physically resting outside your blockchain?	IOG	Basics	FM19; LL in LD18; AM18
4	Did your blockchain solution entirely replace the former process or solution, or are there still alternative ways without the use of blockchain?	VCN	Voluntary use	BH19

#	Question	NPG core element	Category of subject	Reference
Now, I would like to learn more about your motivation for dealing with blockchain.				
5	What were the reasons and motivation for introducing this blockchain solution? *Sample motivation: efficiency gains, attempts to open up government, increase trust of public*	VCN	Motivation	BJ in OV18; KS in LKP16; HV in OV18
5.1	What role did the other stakeholders, e.g. citizens or companies, play in your reasoning?	VCN	Motivation	IE in IGI15; BH19
Your blockchain solution is the technological foundation for public services. Going forward, I would like to know how the delivery of these public services has changed by the use of blockchain.				
6	Blockchain is said to change the meaning of intermediaries: did your blockchain solution affect your role as a public administration? (if needed: do you think, users of your public service became more	VCN, IOG	Co-Production, Collaboration	HV in OV18; IB in HW03; BH19; IB in HW03; PP17; KH18

#	Question	NPG core element	Category of subject	Reference
	independent from your public administration by introducing blockchain?)			
7	By using blockchain, how do you now cooperate with other stakeholders when it comes to delivering the public service?	VCN, IOG	Co-Production, Collaboration	BL in TT16; LB in OV18; IB in HW03; TT in TT16; OR in TT16; IE in IGI15; AC in TT16; MW in MW18
7.1	Do you now cooperate differently when it comes to overall or strategic planning or alignment?	VCN, IOG	Co-Production, Collaboration, Decision making, BC Governance	BH19; IB in HW03; OR in TT16; AC in TT16; FM19
7.2	Do you now cooperate differently when it comes to actually delivering this public service?	VCN, IOG	Co-Production, Collaboration, Decision making, BC Governance	BH19; IB in HW03; OR in TT16; AC in TT16; FM19

#	Question	NPG core element	Category of subject	Reference
8	How is your blockchain solution supporting decision making processes?	IOG	Decision making	FM19
9	How is your blockchain solution supporting the resolution of conflicts of opinion?	IOG	Conflicts, Decision making	IB in HW03; TT in TT16; LB in OV18; KR18; BMK18; BH19
10	What role play incentives for stakeholders to participate in blockchain-based public services?	VCN	Incentives	FM19; BH19; AC in TT16; AL in TT16; MW in MW18; JP13
11	Are there components of your public service which cannot be covered by blockchain?	VCN	Off-/On-chain	BH19; FM19
11.1	How important is it to formalize the delivery of a public service? Do you think informal procedures are required (nonetheless)?	VCN	Informal Processes	TT in TT 16; JP13; KH18

#	Question	NPG core element	Category of subject	Reference
12	Do you leverage Smart Contracts to automatically execute transactions for any purposes?	CTM	Smart contracts	FM19; LL in LD18; TT in TT16; BH19

Furthermore, I would like to better learn more about how your blockchain solution is governed.

#	Question	NPG core element	Category of subject	Reference
13	What are the processes to decide on changes to the blockchain setup?	IOG	BC Governance, Structure	FM19; RW18; JP13; PM18
14	Are there any defined rules for node operators and developers?	IOG	BC Governance, Structure	FM19; HVW in MC18; RW18; PP17
15	What are your criteria to select IT developers and operators for maintaining your blockchain IT infrastructure?	IOG	BC Governance	AA17; OUJ17; FM19

(optional, in case time is left)
And finally, I would like to better understand the effort needed to build up your blockchain solution.

#	Question	NPG core element	Category of subject	Reference
16	Have you had any regulatory or legal barriers to take care of before offering your blockchain solution?	VCN, IOG	Law / Regulation	FM19; IB in HW03; RW18: PP17

#	Question	NPG core element	Category of subject	Reference
17	Did you consider any activities to ensure all users are able to use, maintain or supervise your blockchain solution?	VCN, IOG	Training	IB in HW03; KH18; BL in OV18; FM19; OR in TT16
18	Did you experience any user acceptance issues?	VCN, IOG	Training	HM11

Key list: VCN - Voluntary Co-Producing Network; IOG - Inter-Organizational Governance; CTM - Contract & Trust-based Management

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A4.3 Interview transcript – Malta

Interviewee: Ministry for Education and Employment, Malta (via Commonwealth Centre for Connected Learning [3CL])

Type of Interview: Video Call

Date: November, 2019

INTERVIEWER: Alright. Let me run through my questions, and I think most of them will hopefully touch your segments anyway. I'm going to read through all the questions. First, I would like to understand the technical characteristics of your Blockchain solution. So, could you please describe your blockchain solution and its purpose?

3CL:

- So, the blockchain solution, I was involved with and continue to remain involved with a bit of a distances is a blockchain credentialing solution which is built on the block set open standard.
- The end which dovetails into the Bitcoin open standard. Does that answer your first question or do you need more detail? I mean, my area of expertise is in strategy education. And so digital credentials was the project I conceptualized, then ran for the Maltese government from its inception to all the way up to the contract with the contractors Learning Machine being renewed.

INTERVIEWER: So, it means before running your credentials on blockchain, you're basically issuing your credentials by government?

3CL:

- Yeah, I mean, maybe I can explain a bit more of the relationship. I mean, I'm a senior advisor to the Minister for education and employment in my country. (…) I mean, I got involved with the blockchain in about October 2016 and I was with MIT Media Lab, I am speaking to Philip Schmidt on totally unrelated subjects. I was looking at the Accreditation of online education and the regime I was setting up in Malta.
- At one stage, he said „we're doing something with the blockchain with these guys, Learning Machine", who I also knew from other relationships, and the rest is history, basically.
- That meeting was in October 2016. By January 2017, we were organizing, in terms of stakeholder engagement, I was chairing and organizing a large conference on the state of digital education. A huge component of that became blockchain. So, Philip Schmidt was there, Chris Jagger's from Learning Machine was there. So, my involvement came and remains on a strategic level, okay. I'm not a technical guy. I'm only interested in what can you do with technology.

INTERVIEWER: That is fine. I guess, we will not deep dive into the real technical characteristics of blockchain. So, I'm not going to ask you how many blockchain nodes you're running and stuff like that.

3CL: Yeah, you start getting blank faces for me. I mean, if you're going to drill into the technology, because – I repeat – I'm somebody who is only interested in seeing, can these technologies be put to good public use?

INTERVIEWER: Yeah, I'm dealing on the same level of detail as you, so I guess that should work. Do others need the permission to join your blockchain network? From what you've just said, I think that's a closed network and a closed project.

3CL:

- Well, yes and no. The history of the project was that the government of Malta, decided to fund the first pilot to the tune of, I think was 700,000 euros to basically and the first pilots involved, I mean public institutions. So, it is institute for tourism studies, there was the National Commission for Further and Higher Education and the two projects over there. The VET University of Malta called the Malta College for Art Sciences and Technologies, interestingly.
- But what we had done literally was offer it, what I'm saying for you know, I think of me, with the government's hat on, okay. Offer it to everybody around the table who is interested in joining. So, we literally went like, „are you interested?" Yes. Yeah. I looked at the university guys, „are you interested in?", „Well, we need to…", „fine, you are out". It was brutal.
- Two years down the line now, the university is joining now. And again, in terms of stakeholders, the thing to remember. So even though it was offered to all public institutions, and then to all even like private education institutions in Malta, including Sixth form colleges, we call them, so kids aged 16, and now that deep diving into secondary school.
- The objective is that everybody in the education sector in Malta will have their certificates notarized on the blockchain, the next layer's coming up now and coming up soon will be all public records will be on the blockchain. So, there you're talking about health records, car vehicle registrations, birth, death certificates, you name it.

INTERVIEWER: Yeah. That's basically something you're heading to because of your experience that you gained from the educational certificates?

3CL: Well, this is now, it depends how interested you are in politics, how it works with stakeholders.

INTERVIEWER: I know.

3CL:

- (…) we decided to go for blockchain plus education plus certificates before the government of Malta decided that blockchain is really interesting.
- In fact, we went for this before six months before I was actually texted by the Minister for Education saying, „isn't this what we're already doing? Or what is the blockchain?" So that needed to be done an alignment between one arms of government that had gone, right.
- And the other guys from the Office of the Prime Minister saying, „but how does this fit into the general Chain Island strategy?" So this is the way things work in politics. Somebody has a deep dive into wanting to solve a real problem. And that's where we were coming from the education sector.
- From the government sector, we became much more of a political thing, which was one, is there another opportunity to do something with Malta as a small state that has always been technologically connected, this idea of an island lab. „Can we do something with that, to probably, rightly or wrongly?" We have a legacy of having been first in some telecoms, technologies, online gaming. So, this was perceived to be the same kind of thing. Let's go first.
- Okay, so one side, we had people saying, „can we solve a problem with this?" And on the other side, there was the political arm saying, „can we leave around whatever Malta means or doesn't mean to the outside world, strategically and politically to do something new, and then create jobs and all this kind of stuff?" Okay.

INTERVIEWER: (…) Is your blockchain storing all the data on chain? Or is it only storing, like transaction data and you still need other technical (/)

3CL:

- The thing, it's the hash is on the blockchain, then we're using AWS, I think to put stuff over there. When you talking about stakeholders, again, I mean, I'm not going to bore you about GDPR, because that's what everybody is still talking about.
- Now, at the moment globally, we do not have any alignment between GDPR and whatever anybody's trying to do on the blockchain, no matter what they tell you.
- At the moment, there is a disconnect, and until somebody from the commission decides to sort it out, somebody can tell you that, technically, you are not in compliance with the strict terms of the GDPR. Or you can be countries like us, let's say, your problem sorted out, we're doing something for the public good.
- But I can assure you that the discussions with the data protection commissioner in the early days were energetic. And it's also because if you look at stakeholders even as something as simple as digital credentialing, okay. (…) There are the videos of me speaking about this kind of stuff where you look at how many stakeholders are involved in this thing, and it's very easy to end up with lawyers, accountants, tax people. And you are even all the way up to the Prime Minister, communication people.
- So, these are all human networks that you need to manage when you're trying to do a nation state application. But anyway, that's the long answer to your, what's stored on the blockchain?

INTERVIEWER: That's fine. What were the reasons, the motivation for introducing this blockchain solution? Was it kind of politically only or were there other reasons as well?

3CL:

- Okay, like most things, it's a mix of both.
- So it was, I would say a happy accident plus people being in a position of influence, which I was at the time. In other words, I came back from my trip at MIT Media Lab and, and the fact that I was a trusted bridge between the stakeholders who are working on this, A, B that my business nose told me that Learning Machine who are starting to build the application area around the blockchain.
- Because it's only about block set, it's all open source, it's all based on GitHub, and you can get the code over there. I could go back and I literally met the minister like a week later, and I said, „I think there's an opportunity" and his answer was very interesting. "Opportunity to do what?", and I said „here's a blockchain, distributed ledger technologies". I started ticking the words self-sovereign identities. And he said, „Wait, is this of any use to citizens, A, B is this going to be of any use to the institutions, B, and entry politically, is this something that we could defend if there are public funds that are going to be spent for? Do you have any trust in these essentially startups like learning machines or MIT Media Lab and five, you can run with this, then it's on your head. Okay. So you are staking your reputation on whatever it is."
- That's where these things work. It's a mix of political, strategic. And that's the way it went. The next thing I had done was organized literally this people who are in based in Dallas and some people in New York and I called around me all the national stakeholders plus the minister. And the Permanent Secretary around there and I knew it was a question of time, we didn't have much time. For me, I realized that I really had to move very quickly and demonstrate something very quickly.

- So, a lot of these things are not based. And it's the same thing I was listening to now in Malaga, okay. It's all based on identity and trust. Yes, that's what the blockchains should be doing, more still in the states where the blockchain is, like, somebody said: "it's like a hammer looking for a nail." It's not the way you need to do it. You need to have a sense of „Do I have a problem this thing can solve?", and I think it does think ticked all the boxes and resonated with the key decision maker anyway.

INTERVIEWER: Okay. What role did other stakeholders, for example, citizens or companies play in your reasoning?

3CL:

- I think when it came to the citizens, I mean, the way we have to play it, because initially I was also fighting for the budget. So this is government coming into it at this stage.
- So, if you look at phase one, two of this project, it literally was the political, financial, data protection, commissioner, lawyers, internal communication stuff.
- In terms of "is it going to be good for the citizens?" in a way, it was left up to me. And then people within the ministry however. You have people who are director generals of curriculum. So, these are the people who are actually building the education materials for,
- So, when I'm saying me, it means it then goes down to one layer, you know. And then you have to explain to these people. "So, is it going to influence the curriculum?", "Not at the moment.", "Are we going to be teaching blockchain?", "Not at the moment."

- What is this about? You have to understand that a certificate is what everybody aspires to get. You are slaving to have PhD so one day like me, you'll get a piece of paper, which you put on your wall and your parents might be proud of you.
- (…) But the idea of certification, accreditation of what somebody knows, and then also, what I also the buttons, when I'm saying I and it sounds like this is some sort of ego trip. No, it reflects the size of the country.
- I had also written the lifelong learning strategy for my country. So, I also played the lifelong learning card with decision makers first, was keeping the citizens at the bay and the lifelong strategy is, there are people of my age who are getting kicked out of jobs (…) and they have to reinvent themselves.
- There are people like my son, age 17, who is teaching English to refugees. And for him, the certificate he got from the NGO who he was working for, is probably more important for him to get into the university, and wants to get to where he's going to get to than the actual A levels or the actual, okay?
- So, once you start to deconstruct that and you deconstruct certificates into credentials into self sovereign identity, but you have to educate. So by the time, so it's an education process that I have to go through with whatever resources I could find as in initially, yes.
- Initially a one-man person evangelist but then the trick is to get everybody, every stakeholder, the stakeholder chain to believe this is their project, that there is something in it for them. And in our case, it wasn't getting anybody from the Prime Minister downwards, all the way down to a registrar who told me "so, do I get extra money to do this? What's this going to do for me? I'm already issuing the certificate, everybody's happy with this."
- So, why the certificate, why digital? And it was that late stage that I then started playing the game of social media apps interfaces with young people, that their

mobile phone is more important than their parents because that's their screen to life, that's the interface with life.

- So, we kept the students, that towards the tail end. Now, whether that was good or bad, I mean, if I had to look at the project, there's a lot of work which needs to be done, okay? Because even if you, basically every single certificate now for anybody age 15, upwards are getting told "Here's your certificates. Now you can go and download the app and activate your private key and everything's working". But there's still work that most people are saying I'd rather be spending my time on Snapchat than doing so.
- That's what I'm saying, when it comes to citizens, it's a completely different communication strategy. And my understanding is that, even from the very intense two days, I've just spent at Malaga now, I'm speaking and everybody's got the same problem. You know, blockchain is not parts. I won't bore you into how I perceive blockchains. Move to another question, okay.

INTERVIEWER: It is fine. Alright, next question. Blockchain is set to change the meaning of intermediaries, did your blockchain solution affect your role as public administration?

3CL:

- Yeah, I think it's will, I don't think it does.
- I think in terms of public administration, I think for initially, it's more work for the public administration, because it's trying to broker all of these arrangements and trying to persuade registrar. Initially, it's more work.
- The promise is automation, the promise is longevity. The promise is also, when I'm saying "political", one of the projects that we sneak in was something like refugees who end up in Malta, with no credentials whatsoever. And that has to be reassessed for any skill set that they claim to have, once they've been tested.

- And it's anybody from saying "I'm a doctor", to anybody who says I can spray a car, okay. Those certificates get issued by the National Commission for Further and Higher Education. Symbolically, that certificate is now notarized on the blockchain. So even if the Syrian University you go doesn't exist anymore, or you don't have it. So again, the political angle is also that.

INTERVIEWER: Okay, alright. By using blockchain, how do you now cooperate with other stakeholders when it comes to delivering the public service?

3CL:

- Needs a bit of a characteristics, they say in a very Graham Shin terms.
- So, you have to persuade people. I think what's happening now is that, since most of the funding comes from government, in fact, all of the funding comes from government. Government says "this is it, you're going to have to do it" at some stage, and you're going to have to do it.
- So if all public health records will eventually end up it won't be health records, which will go, come on stream, I think the next ones are going to be what I heard is rental properties, for example, in Malta, which is a huge. It's a small country with loads of properties which are empty, nobody knows who they are.
- The second thing they gave use is blockchains, let's try to find out who owns these bloody houses. And then try and equate that with the need to start renting out is probably. If you have a government driving in the same this is it, now think in terms of e-government, okay.
- And again, that's part of the legacy of this country. It's always had a legacy of very strong e-government. Government say this is it, at some stage citizens have to abide. If you had to tell me so in terms of public sector, if you had to tell me, do people find this stuff really useful right now, in the education sector, which

was the first to go, it started, you can still. I will tell you the most important thing about innovation is when people don't talk about it. It's just the norm.

- So I repeat my son who was at the conference, I organized actually three, four weeks ago, on the post truth society, for instance. So I had to kind of coerce him to come in and join and be part of a group (…), but the guy turned up to me philosophy in history, but he realized that, because again, we made sure that anybody who attended the conference, the certificate gets issued and notarized on the blockchain. And here it says that "fine, I can download onto my wallet and then when I'm applying for this university, I will also put in the certificate."
- So, from an education standpoint, it's starting to become the norm. From other sectors, they're going to come on stream and by the way, those are not necessarily going to be using the same solutions, where it's going to be block size or something like that. There are tenders going out as we speak.

INTERVIEWER: When we think of how you get to the point of delivering a public service to citizens or companies, when you think of that solution that you have for educational certificates or credentials: Do you now cooperate differently on a strategic level with other stakeholders? You mentioned the process of starting the whole project, has it improved?

3CL:

- A lot has changed since we started. I mean, just to give you a time frames. I'll try and go from digital credentials to what else was happening in the country. I think about a year ago, I actually had a couple of slides I shared at the Frankfurt Business School actually. And I tried to show like the various processes which I go through on how accidental they are.
- So we went from January 2017, to signing an MOU, which means nothing with Learning Machine, who are the people building an interface. We signed the

contract in September 2017 as well to negotiate. Roundabout April was when the prime minister said, we got to become a blockchain island.

- Since that time, but the idea of blockchain then was FinTech. It was not. In fact, education. “What are you doing blockchain education? This is nuts. This is obviously about crypto currencies and stuff like that, right?” If I had to fast forward now, where we are now, there’s basically a junior minister within the office of the prime minister. (…) Legislation has been introduced, FinTech legislation has been introduced, again, to enable organizations to come and rooted more. So, binance for instance, is pretty slow here now. And so, that obviously changes scenario. This is something called the multi digital innovation authority, which is looking at registration of software, which has something to do with blockchain and the AI.
- Okay, I was with this guy yesterday on the plane, the CIO there, okay. And now these guys are simply like a registration hub. Okay, so there’s a whole new ecosystem which is coming in. So, if you look at what those guys are, okay, and they will tell you. But if you now hear the minister, that minister, not the education minister talk, the first thing he will talk about was “we have digital education credentials”. So, will you really believe that this is the part of the DNA of our country?
- The reality, it was a happy accident. Okay, what the government wanted to do first was FinTech, that’s where the money is. Okay, so. But that’s the way politics works, but of course, to align took time. There was a time when I wasn’t very popular, within the office of the Prime Minister, because I was like “what have you guys done? You’ve done” you know, “we’re really going this way”.
- So, in terms of stakeholder relationships, between having to be very horizontal, within these players. And it is like, so you’ve got the public ecosystem of the stakeholders that has and which is all very political.

- And on the outside, you have the citizens. You also have the education institutions that have their own, okay, some of whom resisted. So, the problem with the university was very simple. The CIO at the University of Malta doesn't believe in the blockchain. They actually believe it will go away.
- So, I mean, one of the things I was yesterday with a guy, who's like a CIO with a university in Barcelona, he said "Maybe I should do a swap. Why don't we, I do six months at the University of Malta, and this guy goes and does my job there". Because I also understand the fear associated with people who said "It's a fad, what do I rely on? I will wait."
- Remember, there are many people who say it's too early, I will wait. Okay, so it is complicated territory, really is. You know, so it's complicated territory, but you have to make it simple.

INTERVIEWER: Exactly.

3CL:

- If you want to do a pilot, you have to find the real human needs or human problems that can be solved. And as soon as you start drilling into, you know, the interconnected areas of identity and trust, that's where and that's where you open it up, you have to mind map it.
- And that's what I do in Europe, whether I'm speaking or consulting. I am the bridge between those techie guys, and it's not all good. Okay? We have the techie guys whose idea of self sovereign identity is almost like some sort of automated ecosystem. And you say you keep on doing that but these guys have to decide them and bless it and find the money.
- If you can't find a way of company, it's not going to happen. And we started there and let alone then, the whole thing about decentralization. That's the other

issue that a lot of people have been waiting for the Microsoft, the SalesForces, the IBM to come in and give them that level of trust in the intermediary, right?

- And since that it's been a bit slow. Okay, it's given a lot of people the opportunity to say "Let me wait". And I think we're pretty much in that kind of state, okay, in 2019.

INTERVIEWER: Alright. Thank you. How is your blockchain solution supporting the decision-making processes when we think of that public service that we are talking about right now. So, when we think of blockchain, could you think of voting processes that we apply on blockchain as well? Are there some kind of decision-making processes considered as well for your Blockchain solution?

3CL: I think, so in terms of, remember when I'm saying my blockchains, so you have to be careful as to how I respond about it, I think. You about my, is not my blockchain solution. If we talk about the blockchain solution being the credential solution, or we mean the entire ecosystem of the blockchain in Malta.

INTERVIEWER: The credential solution.

3CL:

- The credential solution, it's at the moment plain sailing. It's a simple question of signing up. The objective being that, I mean university, once the university comes on board that means all certificates for people who do their exams, to go into university that's accepted that all of those are notarized on the blockchain.
- And I teach at university, once all the study unit certificates will also be issued on the blockchain. That's the big tipping point, okay. And, the way it's happened, and that's happening now, over the next six months, it has got it. But it's happened because government has put a big gun on, some people then say

"we are spending money, you come on board, okay?" There's will be no other way about it.

- And I repeat, that's a lot of what's preventing the blockchain from booting in other European countries is when it comes to education is precisely that, universities, higher education are very strange ecosystems. Many of whom are rooted and the power echelons of the 20th century, not the 19th or 18th century, and where people feel threatened. Okay, we thought about, you know, decentralization, automation, smart contracts, all this kind of.

INTERVIEWER: How is your blockchain solution supporting the resolution of conflicts of opinion? So, when we, I think of your process as there's some kind of trust issue, in terms of can I really trust that certificate, for example?

3CL:

- It's a really good question. And I am not even sure I can give you a straight answer because till now, what I've described to you is a process of booting, no, the process of saying you're going to have to do it because the political representatives or the people who are in the public service has been told by the political representatives that this isn't, the country's good.
- See that, okay. In terms of people understanding that the blockchain can resolve because we get rid of intermediaries who confuse, it's early days, my friend. This is what some people at university people like me or people in the political sciences faculties will be talking about, is this part of the vernacular that the ordinary citizen knows that the blockchain can resolve conflicts or you can have totally different political voting systems.
- I mean, I was in, I can give you an example in Italy, for instance, because I've been involved in some stuff over there. People are really looking at how you

can use blockchain to resolve issues related to trust and politics and voting, okay. But in this country, it's early days.

INTERVIEWER: What role play incentives for stakeholders to participate in blockchain based public services?

3CL:

- I think, the incentives for the public organizations is simply doing what their bosses would like them to do. It gives them the photo ops, the photo opportunities, it's on the communication side. It becomes a mantra, that here if you read about Malta, right? Malta is a small, you know, 450,000 people here right? Okay, the size of our small city in Germany, right?
- But the fact that, it's deemed to be that there is a political commitment, and it's gone from now, blockchain islands, artificial intelligence. This is something that we can do in small places here where you have access to stakeholders, you can identify the stakeholders and identify the decision makers and they have a face many of them. That becomes part of the DNA of anybody in the public sector that they're deem to say you have to do it. Because it's, again it sounds almost like communist authoritarian or something like that. This is deep down in the political DNA of a country that has never had anything.
- So, when the British left here in 1979, the idea was that this country will starve, it has no natural resources, it has absolutely nothing. And nothing has in starved that it's like, it's now the downside is it's deemed to be, it is like Singapore or corrupt or a mafia state and God knows all sorts of other things, because it's actually done extremely well from an economic perspective. So, it's complicated stuff. There isn't straight answer into it.

INTERVIEWER: I agree with that. (…) Are there any kind of incentives for the citizens to use the public blockchain offering?

3CL:

- Not yet. But I think as because, I think the typical, from education now I'm just going to talk about my role because the other side, once you have public health certificates, health records, because there won't be an incentive and anybody who doesn't have to walk into a government office, so you have to walk somewhere, but you can download it, trust me.
- Everybody has a mobile phone here in Malta. That's why the beauty of it is, so some people will not think about blockchain, people will think it's an app and the other one thing you have to understand. The interface, the app is just another app government tap that I'll do it.
- So, I can't remember what your question was about incentives, what was it?

INTERVIEWER: The question was, what role do incentives play? How important are incentives for citizens?

3CL:

- I think at the moment, in the education sector was just deems to be, when people graduated, they were told "Here's your paper certificates. By the way, here's an email from the registrar if you want you can have this certificate in a digital format and it's notarized on the blockchain", chick, chick, chick. So, the students would say "What is this? Download an app, what do I have to do?"

INTERVIEWER: So, they can decide which way to go.

3CL:

- I can decide, you will always get the paper, because that's what your parents want to frame on your wall, okay, on their wall, that's the first thing. And nobody knows, it just come off a bloody printer and sometimes the ink isn't even good on the printer. (…)
- If you look at it, the certificate actually, there is the hashtag. So it says if you want so people again, that's the clever interplay, which in a way with boxes facilitates, that you just go, he just has to go in there and then people go on the website and say, and you can see it being validated.

INTERVIEWER: Interesting.

3CL:

- So, in a way the education is also happening deep down. What is this stuff about? The bit I have left down is that on a much higher level than what's also happened from an education perspective, as the, because I mean, I may be giving you the impression that the university was totally agnostic to all of this.
- That's the guy was the CIO of the university. On the other side, the faculty for computers sciences is very quick to set up the center for distributed ledger technologies and I'm on the board of that thing. That's had its first intake of master students now, literally and most, and that's, and it was oversubscribed.

INTERVIEWER: I see. Are there components of your public service, which cannot be covered by blockchain, where you say, okay, these are natural constraints, for example, which can never be solved?

3CL:

- I don't know. I can't give you a straight answer on that one, I think. And again, if you're looking at, if you're talking about digital credentials, I can't think of any sector which can be sorted out. I can't think of any institution, which should not. I think in terms of, even in private schools and church school, there's been one entity where again, it's not being served because the headmaster said "Don't do this".
- But I can't think of a reason why, because I guess the linkage between the paper and the digital which used to be deemed to be the PDF. And is now going to be it is the most secure way, that there have been questions. You know, what happens? Who else is there? Once you start telling people that was the masterstroke we use.
- Here is the institution, here is you, I'm giving you something, and it's yours. Now, you'd be surprised how many institutions claim that the certificate was theirs. And I say "No, it is the recipient who slaves for it. It's theirs. You get this and you guys can get blown up, but this person as long as he or she is alive, that's, theirs, that's what they've slaved for." So, there are many philosophical arguments related to that, okay.
- But I can't think of anything within the education sector, where this thing should not be all pervasive and there are many things that they go beyond potentials in education, okay. A university, a higher education institution. So, the entire service ecosystem around it, that I, the blockchain, as long as you keep on looking at things which have identity and trust here can facilitate that alone if you go into things like, what the University of Nicosia and all these people are doing in terms of micro payments and paying by cryptocurrencies and things like that.

- So, the answer is in education, no. In other areas of government, governments are strange beasts, there aren't many governments I know that like losing control. So, decentralization is not exactly going to be very sexy to a lot of people. Again, this then takes us into another thing when you're looking at public blockchains, closed blockchains, hybrid blockchains and which is a total. You know, the government of Estonia goes around the world telling them that the only real blockchains solution was made in Estonia, which of course it isn't.

INTERVIEWER: How important is it to formalize the delivery of a public service. Do you think informal procedures are required nonetheless?

3CL:

- I think you need to be formal and very clear about what you want to do. Because public implies, public sector implies formal, unfortunately, okay? The informal thing is winning the support of people, all of the stakeholders, one can map and directly to what I told you the very beginning, making them believe that it's their project, not yours. That there's something in it for them, for their day to day job, or even if they believed in the, you know, better services to the system. You need and that's a slow process.
- I mean, one of my challenges was a very strategic decision I made, because I'm an advisor to the Minister. I'm not part of the public sector. So, for the first year, I was totally fascist about this. I drove this thing and there is nothing, you know (…)

INTERVIEWER: So, do you think that in the ideal word, everything should be formalized, but realistically, there will always be some-.

3CL: No, wait. In the ideal world, I'm talking about the public sector-.

INTERVIEWER: Alright, yeah.

3CL:

- Okay, not any other sector, I am the least formal person you can think of and it's an anathema to the way I think, okay, because I believe we should educate people enough to know what's good for them and what isn't good for them, okay.
- But in the public sector where you have public accountability, rules and regulations to what you can or can't spend on, tenders, to get a direct order, I've been told about, try and get a direct order where in this case, I had to go in terms of the Finance Committee, Ministry of Finance and say "We want these guys. Why? There's nobody else who can do A, B and C. Why these guys, nobody else." And then you start, you have to educate accountants on the principles of open standards by saying we can, we have to go with an intermediary, a US company so that in two years, century or so maybe we can build the capacity in the country then maybe people from university can come and take this over and pick up the code, okay? But initially, you have to be formal, otherwise, ain't going to get there.

INTERVIEWER: Do you leverage some kind of smart contracts to automatically execute transactions for any purposes, when you think of your educational sector?

3CL:

- At the moment, no. At the moment it, it should, okay, but it should you bet, but at the moment, the smart contract has got as far as convincing registrar's that, you know, to issue the email, "here's all the graduates", and in contract with learning, which means that they get the flat files, or where he graduated, they do all their magic, everything is ready to go, and.

INTERVIEWER: Yeah.

3CL: That's right. But should there be a smart contract at some stage to do that?

INTERVIEWER: I would like to learn about how your blockchain solution is governed. What are the processes to decide on changes on the blockchain setup? So, if you really want to make fundamental changes, for example, now you're running an open blockchain solution. You now, want to have a closed blockchain, who is decided that?

3CL: It's decided at, so in the public sector, everything depends on funding.

INTERVIEWER: Okay.

3CL:

- So, if there is no further funding for the solution that is running at the end of 2020, it's like Houston will have a problem. Okay. That's the way it goes.
- Now, the job, the thing in the public sector than other thing is this, once you've started up something big, it's very difficult to stop it. Because most public servants are inclined to say "Well, we have the budget last year, we want to try it next year". The most difficult thing to do is start off something from new, from scratch, okay.
- Now, in terms of what needs to be changed, it's been pretty much, then that depends a lot about the supplier relationship that you've got in place. So even though it's about decentralization, there's always a blessing the intermediary called the supplier there, what they stands, whether some universities have the internal geeks doing stuff.
- So, it depends on the communication process and being able to go back and forth and say, this isn't working. I think in our case, it's been pleasantly a very

seamless process, okay, that I think it was the supplier had enough time to learn because with these very systematically, one organization get those guys on board secondly organize it.

- So, they were learning along the way and being very quick to respond. But the trick is this, that we also chose a supplier that it was hugely important for Learning Machine. We're going to a funding ground, but of course I knew that okay. That they would not just promise but overdeliver.
- And also what happened was, you know, once this thing started up in the Bahamas, sorry, Bahama previously, set up in Malta, by May last year, I organized the blockchain education conference in Malta, Learning Machine with the inter-American development bank or guys were holding delegations of the government of the Bahama, to come here and see what we were doing. And in fact, they then race the head in the Bahamas, they put a lot of these public services on the blockchain very quickly. But they flew in decision makers, about three permanent secretaries, techie guy, about seven people were around.
- See back to all the old political brinksmanship and who's going to risk most at the moment, you know. We haven't reached that tipping point yet. I think the tipping point will be reached where we don't talk about the blockchain anymore. And it's just another piece of technology. I think, it's not as sexy as it used to be. I wrote my reports on the blockchain education, I co-wrote it in 2017. You know, I mean, its two years later and it still isn't. Maybe, that's my usual long answer to your simple question.

INTERVIEWER: So, let me try to summarize what you've just said, basically trying to get the main points out there. So that means when we think of who's actually in charge of making the decisions that might affect the further development of that blockchain solution. That's basically the government making the decision.

3CL: In this country, absolutely. Government has been the chief sponsor of all of this, was, is, and remains.

INTERVIEWER: Are there any defined rules for node operators or developers? So, when you think of the suppliers that you've just mentioned, have set any rules that they have to follow in order to make sure that the blockchain solution runs or is developed in a certain way?

3CL:

- No, if anything, what we did was the opposite. We custom build stuff that could replicate their real-life world as closely as possible while still giving them the advantages, the basic advantages of what blockchain does.
- I think most people just thought in terms of this something where you go, you know, you have a digital certificate, nothing else. So, the answer is, we custom built everything, I guess, to meet the demands of the stakeholder, okay? Now, you can afford to do that in a small place. You may not afford to do that in Germany, okay or in other places like that, or even within Germany and the one of the problems there is at the moment with the blockchain and even this EPS, Cyprus, it was Germany, there are different regimes, even in terms of how education.
- So, that's it because of this European blockchain partnership thing. If the German who are there looking at somebody who draws flowchart. So, this is the way processes work and say "no, they're doing it differently". So, we had the privilege, government bank, governments saying it needs to happen, but then being flexible enough to say, you guys at the ground level, who know the end user, the learner, okay, what do you really need and then trying to replicate as much now.

- This might be counterproductive, it might seem like we're not really using the benefits of the blockchain, smart contracts being one of them, right? And putting all of that to dramatic use.
- I'm a strong believer that if you want to have real innovation, okay, push it out. Make it very closely aligned to people's real world. Think of it as a Facebook, how that went from being you know, post Friendster, the Facebook to the horrible mess we're in right now. And you build trust that way. So, it's quite funny in a way. It's like radical leadership in saying "you needed to get to have this", but at the same time from an interface basis being prepared to make life as easy as possible for those guys who are in the trenches of having to do something extra. In our case those were the registrar's okay, of individual higher education institutions or even sixth formers, even schools.

INTERVIEWER: Okay, so three more questions that I'd like to run through kind of quickly to save your time. What are your criteria to select IT developers and operators for maintaining your blockchain infrastructure? That's is a technically question. I know it.

3CL:

- No. I think, let us start, the specifics of the multi situation with credentials is a block cert. W3C. So, open source. At the moment, are we locked in with these Learning Machine guys. Yes, till 2020.
- Do I believe that the University of Malta or the private sector is going to be in a state that it can take over? I don't know. Could it be, however, that in 2020 governments comes up with some other new blanket system that is bought from which may not be as open? But you say, we're going to use the same standard as we have for the health records where they have to be closed because of you know, GDPR, God knows whatever, then that can change.

- So, we have an open channel and I sit on the board of the center at the university. So obviously, there is anybody who's doing a computer science degree at the moment, I mean clearly blockchain is a core part of the component. The interesting thing is this – and this is from the European blockchain forum: A lot of people are saying the skill sets that are missing right now, are skill sets for business managers and change agents who can bridge both worlds, okay? Because in doing anything with blockchain implies change. So, it's those kinds of people.

INTERVIEWER: So yeah, that's kind of a basically the next question, did you consider any activities to ensure all users of your blockchain solution are able to use and maintain or supervise your blockchain solution. That goes into direction of training.

3CL:

- Yeah, very basics at the beginning. We were insisting that Learning Machine comes up with videos. If your end user is at kids age, 19 or like my son, people learn using YouTube now respectable people tell you what University is.
- That's it, we all learn and so coming up with videos is there: how does this thing work? What's a good view and then is what you have to do very simply, because most people don't read anymore. That was part of my strategy. And there's a lot which needs to be done.
- I repeat in my case, I'm now one step removed because I'm doing other stuff in Europe basically as opposed to this one. But I don't think there's any difference. I really strongly believe that you have to make this stuff less technologically deterministic, and much more user centric. To make it user centric, you have to use the interfaces that user normally uses, and that means sadly, social media.

INTERVIEWER: Yeah. Alright, and basically the last question I have, did you experience any user acceptance issues? So, when you came up with the first version of your blockchain solution?

3CL:

- Yes, in terms of people are just too lazy to even to download the app. It's as simple as that. And there wasn't enough done at registrar level to tell people "Why haven't you downloaded the app?"
- Because again, get into the mindset, again we might have guys thing? This could be the Prime Minister's office and you know, down here, the registrar was "I have a job to do". I've printed the certificate on the printer. Yeah. I've told them I've issued the email. I've told them how it's going to get done, Learning Machine guys. Of course, I've drafted everything. From that point on, I know it is like, just like, it's for you too, you know.
- And also, you get to the stage if you have to think philosophically you know, am I going to force a kid, you must, you can educate against and say, this is really good if you download this. Because you've got a copy of the certificate.
- And by the way, it also means that in the future, you can decide which one of these certificates to share with which ultimate stakeholder. Okay? Because you might have had a bad transcript of something here was, if people go to your university get the whole lot, we can cherry pick, you know. So, but these are stories that have to be told, at the lower level. So, has that been done successfully? Should it be done successfully? You bet, yeah. You know, and I think that's the same with any kind of new application of new technology. People will kind of feel the way around and see if it's useful for them.

INTERVIEWER: Alright. So, basically, that was my last question. (…) Thank you so much for your time.

3CL: No problem.

INTERVIEWER: Really, really helpful. Very interesting. Thank you for your insights. And if I have any questions afterwards.

INTERVIEWER: Alright, thank you very much.

3CL: Take care.

A4.4 Interview transcript – Sweden

Interviewee: Swedish Mapping, Cadastral and Land Registration Authority, Sweden

Type of Interview: Video Call

Date: November, 2019

INTERVIEWER: Thank you very much for your time. Before we start with the actual questions, I would like to give you some introductory remarks on what is going to happen within the next 60 minutes if that is okay for you.

SWEDISH AUTHORITY: Yes, of course.

INTERVIEWER: This interview aims at demonstrating the importance of stakeholder involvement to successfully realize Blockchain based public services as far as know, you are one of the few public administrations actually in the world who really have significant experience in Blockchain projects. So, it is kind of rare opportunity for me to talk to someone who really knows the business around Blockchain. And whenever I refer within my questions to public service, this refers to your service with respect to land registry and that service you are offering to citizens or maybe even businesses. (…) It is kind of important to me to run through all the questions because I am going to ask those questions to other administrations as well just to make sure that the research method remains stable. Alright. Do you have any questions before we start with the first question?

SWEDISH AUTHORITY: No, let us go.

INTERVIEWER: Alright. So first I would like to understand the technical characteristics of your Blockchain solution. Could you please describe your blockchain solution and its purpose?

SWEDISH AUTHORITY:

- Well, I am not technician myself so it will not be in technical details, but the solution was that we finally ended up with private Blockchain solution concept where we had a number of nodes, not so many.
- Those nodes set out to be in each of the partners or the stations. Now, all the partners did not have a node, so we end up with like five nodes or something like that.
- The Blockchain in itself did not contain the actual contract engine that we invented. The contract engine was something else - like an application to this Blockchain. And the end, result was that they finally recorded some of the steps of the process to the Blockchain and that was it. Again, I need to clarify this Blockchain solution is not in production. It is not used in any way right now.

INTERVIEWER: Okay. Is it only like an internal Blockchain or is it still somehow on a kind of pilot status?

SWEDISH AUTHORITY:

- The aim was not to have it like in the production system.
- We just did this to show it was possible. It was the small-scale production-like Blockchain solution. It would have been possible, of course, to use it for these purposes or other purposes but it was not like.
- It was just a proof of concept or something like that. It was an actual solution but we did not scale it up and we didn't use it.

INTERVIEWER: That is fine. What were the reasons and the motivation for using this Blockchain solution?

SWEDISH AUTHORITY:

- We had different reasons in the different organizations that work together on this project.
- The reason for my organization was to explore the technology and how it could be used for our purposes as a public entity with responsibility to keep public registers and to drive the legal development on digital contracts. So that was our main purpose.

INTERVIEWER: Okay. And what role did other stakeholders, for example, citizens and companies play in your reasoning?

SWEDISH AUTHORITY:

- The other stakeholders and partners in this project played the role connected to their profession or their professional area of interest, the business area, and that could be that they were like the state agents, they were banks, they were technical consultants. The roles in the project were very much connected to what they represented in their process of selling or buying property.
- And their interest to participate was probably about the same as we had: To explore, to learn but I can say that there will probably also public relation interest connected to this because we draw a lot of attention and we had a lot of interest connected to this probably. So, I guess it was good money to invest in public relations.

INTERVIEWER: So, you are very much focused on business stakeholders and less on, let us say, citizens? Is that correct?

SWEDISH AUTHORITY:

- It is very difficult to connect with citizens when you talk about seller or buyer of a property because we have hundreds and thousands of sellers and buyers, and it is hard to connect with them.
- And there is not like an interest group representing them or something like that. So therefore, no. But we did finally have a seller and buyer connected to the project and the buyer was very interested in the project, and he was very involved in the last phase of the project.

INTERVIEWER: Blockchain is said to change the meaning of intermediaries. Did your Blockchain solution affect your role as a public administration?

SWEDISH AUTHORITY:

- We were of course aware of that when we started out and we were aware of it during project time. And then we, of course, know about this right now but we do not see our role be different in a closest time and now, I mean, in 10 years or 15 years
- I do not see that our role be changed because of Blockchain. It still needs to have some sort of guarantee in the end of this very important transaction we talk about.
- Therefore, I do not see that right now. You need to have some sort of guarantee in the society that you place us as that guarantee if you think of public entity.

INTERVIEWER: Could it nonetheless change the degree of independence from public administration? Do you think that it is possible?

SWEDISH AUTHORITY:

- It certainly would be more effective in a society where it can use Blockchain transaction systems. It would certainly be much more efficient and, of course, in a way, if you identify public entity or the public organization as an organization with lots of people that handles paper, well that is certainly to be replaced.

- But in some way, if you look at the functions, the functions you see in the process of selling or buying profited, you need to have some sort of advice, advertisement of how to sell it.
- You need to have a seller. You need to have a buyer. You need to have financing of the process and you need some sort of verification that everything is alright. You need identification of the object of concern and identification of the persons involved in this.
- Therefore, I see the roles and the functions of these things. They still need to be there but they could be replaced by automatic functions or machines or something like that of course. But, still, the responsibility and the role of each function that is needed to be there. So, therefore, as far as it goes for organizations with a lot of people that had this paper, yes, it will be changed but I am not certain that each of these roles will be replaced. It will be the same but maybe in the machine way or automized work.

INTERVIEWER: When looking at your POC in the land registries, how do you foresee the cooperation with other stakeholders when it comes to delivering the public service? (…)

SWEDISH AUTHORITY:

- Yeah, it is about the same. I think the client will still be there for a very long time because they have the finances and it is very rare that you can finance or purchase of a property yourself without the involvement of the bank and of course, the role of the bank or the bank could change and you see a lot of internet banking today.

- So, of course, it could be another bank but I do not see that function of the bank will be replaced by the Blockchain.
- And maybe the real estate agent will be replaced by something else and you see that today because you have a lot of brokers on the internet today that just operate on the internet and one of the most popular services on the internet in Sweden is one that with properties. Because we in Sweden like to look at that. I do not know if it is some sort of secret fantasies or something like that.

INTERVIEWER: So, when you conducted the POC, did you also look at the question how your, let us say, business process in the background should actually look like when run on Blockchain?

SWEDISH AUTHORITY:

- Of course, we did that because we had to start to identify the actual process and then we went on because the thesis for the project was that to prove that Blockchain could work for the process of selling and buying a property.
- If we saw things that we needed to change or to adjust because it was a new technical solution to support this process, well we did that of course.
- But in fact, we did not find very much that we had to change. The only thing we changed was that measures or the tools to work proposals.
- So, instead of paper contracts or paper documents for real properties, we used the digital contracts agreement. So, in that sense, no, we could not find any actual steps in the process that had to be deleted from the process.

INTERVIEWER: So basically, the business process remained the same. It is more like that you digitized the actual process?

SWEDISH AUTHORITY:

- Exactly. And the actual process, there is a lot of steps that you can see as transaction steps so that the steps that you need some sort of proof of work or verification like the contract.
- And these things are there because you need them to get the verification for someone. You need to put up some sort of proof that something has happened, and you still need that in the digital world we see.
- There are steps in the process that have to be taken and you need to have verifications of that but the whole thing we do is to change that verification to digital verification that is proof, safe from corruption and so. So that is the look of it.

INTERVIEWER: How could your Blockchain solution support decision-making processes within your business process? Could you somehow make decision-making easier by using Blockchain?

SWEDISH AUTHORITY:

- Well, I think Blockchain in itself is not smart. Blockchain is not something else that is very logical transaction to the role of process that moves something from one step to another. It is not like it is thinking for you.
- Therefore, everything is introduced and that is the thought of someone. The logical programming is proved from someone.
- Therefore, the regulation or the protocol for Blockchain has to be made up by someone and, of course, when you do that and if you can authorize steps in process, that is of course easier for you but the decision taking.
- I do not see that come from the Blockchain, not even if you really have these smart contracts so to speak because they are not smart. They are just logical.

INTERVIEWER: Do you plan to use any smart contracts within your Blockchain solution or is it not part of your POC?

SWEDISH AUTHORITY:

- Again, let us call them smart contracts but we could also call them effective contracts or something like that.
- But these effective contracts were used, yes, but it was not that they were to put directly into the Blockchain. They were extracted from contract engine so to speak.

INTERVIEWER: What role play incentives for stakeholders to participate in your Blockchain based public service?

SWEDISH AUTHORITY:

- Of course, we had incentives to participate. We did not attract anyone from our side.
- We did not sell this project from our side. Actually, it was one consulting company that was in that kind of role that coordinated and put the project together and showed who to participate and so on.
- It was a price tag for each and every one that participated in this project, and that price tag was set by this organization. Because their interest to do this was partly to add some money of course, because it was a private company and that was the thing for them to do.
- But we did not object to that because we saw that our interest was to participate or that, for our reasons, we got what we wanted and that was it.
- So, everyone was there for their private interest and the interest they put up was of course was actually to earn some credits for it, that they were into Blockchain world and they would be famous for it for participating, doing this and so on. So that was one interest and then the incentive for them to participate. And there was that they had a learning experience of course.

INTERVIEWER: How important is it to formalize the delivery of your public service? Do you think informal procedures will be required nonetheless?

SWEDISH AUTHORITY: How do you mean?

INTERVIEWER: I mean, when you think of Blockchain, there are some people that tend to say you could do everything on a Blockchain because when everything is normalized, formalized, you just need to run the code. It is either 1 or 0 and that is the kind of formalization. And I was thinking is it really feasible to believe that everything can be 1 or 0?

SWEDISH AUTHORITY: Well, not in my world. I am a lawyer basically. So therefore, in my world, nothing is never 1 or 0.

INTERVIEWER: Why do you believe that when it comes to a Blockchain solution, your Blockchain solution?

SWEDISH AUTHORITY:

- I think there are things in the world that could be made easier of course and things that you do not have to argue or put up, then you had actually 1 or 0 or black or white or what do you say. And if you can do that, that is better than not having the things in that way because it makes it easier (…).
- If you put everything on the Blockchain, then you probably need to work with AI or something like that in order to have all things that you just said.
- Saying yes or no cannot be considered because it is impossible to make just logical programming in order to put the protocol to have all the things there are in the process of selling or buying a property.

INTERVIEWER: When we think of changing the technical solution of your Blockchain based service, who would make the decision to change your Blockchain solution? Is it only you as a public administration or are there other stakeholders involved in that decision making?

SWEDISH AUTHORITY:

- And now you come to the very hard questions to answer because that is one thing that we do not have an answer on yet.
- I think this is the open question for everyone that is with Blockchain solution today and this was the strangest thing that the rumor that Blockchain solves everything.
- The Blockchain will rule out the necessity of having public administration, banks, real estate agents and so and so. But someone needs to be responsible for the protocol of the project.
- Not the protocol, yeah. How do you decide on that? It is not like that everyone in the distributed system has the vote for something like that. Someone else is doing it. Especially in the private Blockchain that is.
- And how do you deal with the completed public Blockchain. Someone has to do it.
- So, I think it is a very important question for all the communities that handles Blockchain to discuss this and to come up with a solution because if we are to go for Blockchain solution in any way in the future and we had a public tender and Ethereum is the one that answers, who is Ethereum? Who do we deal with? Who is responsible for the Ethereum Blockchain protocol?
- This is the real problem and especially when you put it in contrast to what we are at the public entity with the great responsibilities of all the information we care for, land registry information, all the land the property registers. Who is responsible for that? Well, no one else could be responsible for it, it is us and I

do not think Ethereum takes the responsibility of any wrongdoing when it comes to the Blockchain.

- So, this is really really the big question in all of this.

INTERVIEWER: Did you try to look at those questions within your POC as well or was that something that you tried not to cover within your POC?

SWEDISH AUTHORITY:

- We were aware of the problem from the start and we tried to look at it of course and we tried to solve it because we saw just in this small project where we have just a number of actors, certain actors or something like that.
- But we discussed: how would we go on to share our responsibilities and so on in the final end if we go on with this solution and we actually did not solve it there.
- Well, it can have different kind of consortiums or something like that but again, you need some sort of framework of your responsibilities and we do not see that. We actually do not see that. So, it is still an unanswered question of course.

INTERVIEWER: You do not see that to happen or you do not see that kind of framework lying outside the public administration?

SWEDISH AUTHORITY:

- I can see different solutions that we work of course but I do not see a complete the public Blockchain solution for us. I do not see that.
- The best example I think for us as a public entity is the European initiative on the European Blockchain infrastructure. (…)
- The best example that could work for us is national Blockchain solution within the public administration but we want to see that the European Blockchain infrastructure being developed right now that is an example of that because I

think the European Union is actually a very good distributed network that could handle solutions like this.

INTERVIEWER: Do you see any regulatory or legal barriers to be handled before you could actually offer that Blockchain solution to a broader community? Are you still there?

(Internet connection disrupted and reestablished)

INTERVIEWER: Let's continue then. Where were we? We were talking about the frameworks necessary to really run an open blockchain solution. And I understood what you were trying to say and you were referring to the European solution, to the European efforts and you were basically saying that this might be a good way to start in order to get some kind of framework in place.

SWEDISH AUTHORITY:

- Yes and I think the European Union as an organization or a network is an excellent of handling blockchain solutions.
- But again, it's still private and not public blockchain we are talking about.
- And also, if you ask this if there are regulatory problems with this and so on, then I started to describe the problem but then the problem you didn't hear that answer.

INTERVIEWER: That's fine.

SWEDISH AUTHORITY:

- Because the thing I said is that, it's the same kind of problem that is forcing us to use private blockchain instead of public blockchain because we don't have regulatory frameworks that allow us to be distributed partners or existing in ecosystems without the centralized feature to handle things and so on.

- So, all the finances and all the responsibilities and I believe this we have, it's connected to the fact that we had legal systems about centralized figures.

INTERVIEWER: Within your POC, did you experience any user acceptance issues?

SWEDISH AUTHORITY:

- No, no. We did not. As we didn't expose it to so many users.
- The user we got from, in our project and of course the seller, buyer they were there voluntarily. We didn't force them to participate.
- So, everyone was happy with this.

INTERVIEWER: Did you consider any activities to ensure that the users involved in your project were actually able to use your blockchain solution, sort of training for example, or any kinds of that?

SWEDISH AUTHORITY:

- We did a lot of it.
- We did try it and we were quite a number of people involved in the project that actually tried the user interface and tried the transaction process and so on.
- So therefore, we were quite happy with the possibility to actually develop a good user experience. Even if we didn't scale it in a wider perspective.

INTERVIEWER: How important do you think is training when we think of a solution in the future for all the users to actually really use that application?

SWEDISH AUTHORITY:

- I think you should be able to use it without any kind of training.
- I think it should be intuitive and user friendly in that sense and then you need to have that because if everyone.

- It's like when you publish a service of any kind on internet or web or whatever. You need to have an intuitive way of acting with.

INTERVIEWER: Alright. We ran through all the questions. Do you have any questions?

SWEDISH AUTHORITY: No not so far.

INTERVIEWER: Alright. So, again thank you very much for your time. And in case you have any questions later on, please let me know anytime. Drop me an email and thank you.

SWEDISH AUTHORITY: Thank you.

A4.5 Interview transcript – City of Zug, Switzerland

Interviewee: City of Zug, Switzerland

Type of Interview: Phone Call

Date: November, 2019

INTERVIEWER: Good morning. How are you?

CITY OF ZUG: I'm fine, thank you.

INTERVIEWER: First of all, thank you very much for taking time. It is a rather rare opportunity to talk to someone, who really has first-hand experience. That's why I am really thankful for this opportunity. If it is okay for you, we would start this interview now with some introductory remarks?

CITY OF ZUG: Please, wait a moment, (INTERVIEWER: Of course.) I'd like to close the door first… Alright, I'm ready.

INTERVIEWER: Perfect. Like I said, some introductory words first to let you know what this is about and the general set-up. Then, I suggest, to could start with the first questions. I have prepared some questions. I would be happy if we could work through those. (CITY OF ZUG: Good.) Like I said, I am PhD student at the University of Potsdam and within this function I am currently analyzing existing blockchain projects to better understand to what extent public those projects have changed public administrations. With this interview, I'd like to understand the importance of stakeholders in particular. So, in what way did your blockchain project, which you implemented for the City of Zug, influence the collaboration with other participants, for example? Und when I say "public service", I'm especially referring to your digital ID that you have implemented, respectively that you are using now and is said to be run on blockchain. As a basic condition, it might be important to mention again: your participation in general and your responses in particular will remain confidential and anonymous. Data from this research will be kept under lock. No one other than me will know your individual answers to my questions. This interview will take approximately 70 minutes. Apart from that, it is important to me to ask you: Do you approve to the record of this interview for the purpose of my own documentation and analysis? Accordingly, this record will only be accessible to me. Because otherwise I would have to write down everything while we are talking - and this may distract me from our conversation and- (CITY OF ZUG: This is no problem at all, yes.) Perfect. I would then start the recording any moment. Do you have any questions before we start? (CITY OF ZUG: No, you can start.) Okay, then please give me a second. Alright, then let's start. First, I'd like to learn more about your blockchain solution. Could you please explain, what your blockchain, let me put it differently, I ask every public administration the same questions, although I may have an idea about your answer. For the sake of completeness, I would like you to ask these questions, nonetheless. Could please introduce your blockchain solution and the purpose of your blockchain solution?

CITY OF ZUG:

- Based on a digital identity, which is based on a blockchain solution, Zug has tested various possibilities of application to see what can be done with those kinds of blockchain-based identities.
- For example, Zug has conducted a voting, which also plays an important role within blockchain.
- On the other side, one can you this digital identity to identify oneself physically

and digitally. For example, with this electronical identity, you could identify bikes, or respectively rent them and before you do so, you identify yourself to be the person, who is allowed to drive the vehicle or bike.

- It was about gaining experience to understand where blockchain-based digital identities present benefits compared to a digital identity, which is not based on a blockchain solution.
- It is pilot project and it primarily aims to allow Zug, as a public administration, gain experiences.
- In Switzerland, there is huge discussion about a national electronical identity. The federal government wants to implement this digital identity and this is based on a central solution. And the second problem is, the very same should be issued by private institutions, not by the state. There already is referendum against that. The City of Zug wants to demonstrate with their solution, that there are other possibilities, where citizens are in the center and not identity provider. That is the basic idea behind the electronical identity.

INTERVIEWER: Yes, very interesting. That means, when you say, that you have tested that, that this is a pilot project. Is this pilot project already completed or what is the status?

CITY OF ZUG:

- The pilot project is not competed. The pilot project has no end date on purpose.
- Rather, the City of Zug wants to build on those experiences, gained in this pilot project, to define a final solution. This is planned for next year.
- If this final solution will look one-to one, is not decided yet.
- There will be changes, because they will continue to work with third parties.
- It is important to note that people sometimes think that one could do everything with this digital identity. This is not the case. There are 300 to 400 users, who

support the process and participate in the project. (INTERVIEWER: Good. This is good.)

INTERVIEWER: But your solution is much more advanced that other. So, this should not scare you of. (CITY OF ZUG: (laughs)) Would this blockchain solution replace the established process respectively the established solution entirely or would this continue to exist as an alternative way without blockchain?

CITY OF ZUG:

- In certain areas, where the electronical identity is really meant to represent an ID card, it would of course replace existing solutions. But when it comes to existing processes, where this e-ID simplifies the access, it could simply be an additional possibility, a simplification for citizens to get in contact with the City of Zug.
- So, it would be a simplification. For example, when you login with your e-ID, you don't have to enter your name and address and similar things. If you don't do it, you would need to fill it out every time.

INTERVIEWER: And what were the reasons respectively the motivation for the introduction of your blockchain solution? You have already mentioned the development on federal level in Switzerland. Were these the only reasons or were there others, as well?

CITY OF ZUG:

- The City of Zug is the center of the so-called crypto valley and even the first public institution in the world, which accepted in 2016 a cryptocurrency as an instrument of payment.
- Back then, when the city decided to accept Bitcoin as an instrument of payment

in order to gain experience as a public administration and to understand what this blockchain technology respectively cryptocurrency can have an impact on a public administration.

- We, then, quickly realized that cryptocurrency respectively Bitcoin – to be precise – is one field of application of the blockchain technology, but maybe not even the most reasonable field of application.
- Then, the city decided to gain experience in areas of public administration, which we found interesting.
- City of Zug has then started this project with partners from the crypto valley. So, on the one hand, with Ethereum, who you may know, with uPort and with a university of the City of Zug, where all participants brought in their experiences.
- All participants acted more like researchers in this project.
- So, we started with this electronical identity and then said: "okay, now we have this electronical identity. It would be great, if one could use this for something." And then came up with the bike idea.
- We then said, a major topic in Switzerland are elections and voting, and concluded that the blockchain technology could also offer advantages for this occasion, and, thereby, moved from one project to another.

INTERVIEWER: And which role did other stakeholders, like citizens or companies, play in your decision?

CITY OF ZUG:

- For one thing, companies which participated in their project, of course, they were partners in this project. Other crypto companies were not involved in this project. Citizens were only involved insofar as citizens interested could participate in this project, for example, who could use this identity.

- There was no election of a group of participating citizens, instead people were called to participate. 300 to 400 people answered the call, though. A majority then also participated in eVoting, made a voting. When you are that much interested in stakeholders.
- Of course, City of Zug had close contacts to stakeholders from the crypto sector, in particular. And that was mutual. That was very very instructive. On the one hand, they could learn from the City of Zug, what the city needs. On the other hand, the City of Zug has started to understand, where the potentials of the blockchain technology lie.
- What was also very important: by the way, it was the initial decision of the City of Zug to accept crypto currencies as instrument of payment: the city wanted to find an access to those companies. And, the city is increasingly perceived as an equal partner, with whom one can discuss topics at eye level. And this was very important for the city in the whole process.

INTERVIEWER: Yes, this sounds very exciting. Do you believe that your blockchain solution will change your role as public administration when it is in production?

CITY OF ZUG:

- Yes, I believe that this is the case. (…)
- I am convinced that, when the blockchain solution prevails in this way or another, that it will have a strong impact on the public administration.
- Wherever the public administration acts as an intermediary, respectively acts confirmatory. For example, when you transfer real estate in Switzerland, the municipality acts confirmatory and that the property moves from A to B. And especially in those cases, this project could change in the mid or long term.

INTERVIEWER: Is this change already foreseeable in your pilot phase? You already mentioned, you were able to recruit 400 participants. Is this already foreseeable in this pilot phase?

CITY OF ZUG:

- No. (…) You could see here multiple possibilities emerging. In the end, these processes will then prevail when a certain degree of standardization becomes visible.
- That means, when we do not have to work with pilot projects, but there is some sort of "Microsoft solution" for blockchain which is easily applicable, user-friendly and also leverages effects of scale.
- When this is fulfilled und applications are used in certain areas, it will be possible. But as long as we are in a phase, where various pilot projects exist independently, not one or many standardized solutions, it will be difficult that this will spread extensively.

INTERVIEWER: Usually, there are public administration without blockchain solutions, which plans autonomously how a public service should be delivered. And when, as you said, this role should change, then the question arises, is this also changing the way a public administration plans a public service or maybe how it aligns with other stakeholders?

CITY OF ZUG:

- This is already a little bit different today. When, for example, there are processes which affect companies or citizens, then the city does not simply define how this process should work, but aligns with the partners, how this process could be beneficial for both, respectively how it is feasible for both parties.
- Thus, the city is already in close contact with the stakeholders. This is rather

independent from technology. It rather depends on the mindset of the public administration. And the city is a very cooperative and open public administration and before a process is implemented unilateral, it already today reaches out to stakeholders.

INTERVIEWER: That means, this will not change through the implementation of the blockchain solution?

CITY OF ZUG:

- No. What could change through the blockchain solution is, that the focus could change, where the sovereignty of data is, for example. Today, there is many many data with the City of Zug. And especially when it comes to this digital identity, which was implemented by the city, the city based their believe on the model, that data sovereignty lies with externs, so with citizens or companies. The city is simply granted access to this data, whenever it is needed.
- That there is a change, today the City of Zug has the population register and really a lot of data about their citizens, which the city partly does not need, but still has to collect.
- This will change in the future, that the city will need to search, that the city save the necessary data of people, because they allowed this. This could lead to a change through the blockchain technology.

INTERVIEWER: How do manage the data with your project at the moment? Where do you store the data?

CITY OF ZUG:

- The data remains with the citizens. They put their data in an app solution. They will then be saved in a protected area of your, for example, mobile phone or any other device.

- And the people then come by at the City of Zug. City of Zug confirms that this data, that was entered by citizens in the app, is correct. And then perform the certification. This certification is then linked with the blockchain and this certification remains intact as long as the citizens does not make any changes on the mobile phone. This is then confirmed by a green checkmark.
- As long as the green checkmark is present, others can assume that the City of Zug vouches for this data.
- And if a person who has such an e-ID now identifies himself somewhere, then this person can decide for himself what part of the data he wants to disclose to the other person. And for example, if you register online with this e-ID at the City of Zug somewhere, you will be asked: "Is it okay that your name, address, date of birth, for example, are released?" Then you say "yes". Or you say, "No, I just don't want name and date of birth to be shared."
- This is what City of Zug means by data sovereignty.

INTERVIEWER: How does the blockchain solution influence decision-making processes in your public service?

CITY OF ZUG:

- It actually depends on the public service. Blockchain solutions can be one, but there are of course other possibilities, but at least one way to increasingly digitalize processes.
- For example, I have seen this in the electronic voting that it has done. In Switzerland you usually vote by mail today. (…)
- But a blockchain solution makes it possible for you to make these processes secure and completely digital. It used to be possible for you to use your mobile phone to take part in this voting without having to enter into correspondence

somewhere

- With a blockchain solution, you can increasingly create secure processes that are digital and thus, of course, change and simplify the processes afterwards.

INTERVIEWER: What role do incentives play for stakeholders to promote the use of your blockchain solution?

CITY OF ZUG:

- Incentives play a minor role.
- More important is that you can apply a solution that exists. That there are concrete and practical use cases.
- It is important that you can not only use such a digital identity for one thing, but that there are many possible applications.
- It doesn't make sense if you have to create a separate or different identity for each process or if you have to register somewhere. It makes sense that this compatibility between different processes is possible, so that the customer or citizen can easily do a lot with one solution.

INTERVIEWER: So, you're saying that if the blockchain solution were just for one service, then the incentive for citizens would not be so great. In fact, it needs more services. (CITY OF ZUG: Exactly.) What do you think are there components of a public service that cannot be covered by blockchain?

CITY OF ZUG:

- Of course, there are many.
- Blockchain solutions are really at the center of attention where the public administration has an intermediary function or a confirmation function.
- But wherever the public administration acts in a sovereign capacity, for

example in the case of permits and so on, City of Zug has not yet identified any field of application for itself. But we would like to be taught a little differently here as well.

INTERVIEWER: In other words, if you think about your digital identity now, do you think it can be used everywhere or are there certain limits?

CITY OF ZUG:

- Simply everywhere you work with the identities. Wherever you have to identify yourself, so "I am the person and it is confirmed that I am that person", there it finds applications.

INTERVIEWER: How important is it to formalize the provision of a public service? Do you think that non-formalized processes are still needed?

CITY OF ZUG:

- Yes. Of course, it always depends on the area.
- City of Zug already has processes that are more formalized, that wherever there are different parties, for example, where you have to follow legal procedures and so on, and wherever, for example, an administration is more advisory, you are less formal.
- This distinction already exists today and I do not believe that it is very much technology-driven.

INTERVIEWER: And do you also use Smart Contracts as part of your digital identity solution?

CITY OF ZUG: No.

INTERVIEWER: If you decide to change the fundamental design of your blockchain solution, for example, you say that you do not want a public blockchain but a private blockchain. What are the decision paths to make this type of change?

CITY OF ZUG:

- City of Zug has set such decisions at a relatively low level. At the City of Zug this will be decided precisely, probably by the head of the IT department together with the interviewee. If it would trigger higher cost consequences, then of course the other political framework conditions will gradually come into play. So up to 100,000 Swiss francs is for Interviewee, between 100,000 and 500,000 for the city council as a whole: that's five city councils and Interviewee. And if it's more than that, City of Zug has to go into parliament.

INTERVIEWER: And are there defined rules for all the people who develop or operate the nodes for your blockchain solution?

CITY OF ZUG:

- Yes, City of Zug made contracts there, but I must honestly say that the head of department made the details, I didn't do that myself.

INTERVIEWER: Were there any regulatory or legal hurdles to overcome before the blockchain solution could be used?

CITY OF ZUG:

- No. That's also one reason why City of Zug has always declared the whole thing a pilot project.
- If the city hadn't declared it a pilot project, there would have been so many hurdles. Because the city declared it a pilot project, we had a great "fool's

freedom".

INTERVIEWER: Could you roughly estimate the regulatory hurdles you would face if you were to translate this into a definitive solution?

CITY OF ZUG:

- As long as the City of Zug simply offers an additional channel, such as issuing an electronic identity in an area where the City of Zug is already active today, hurdles are viable.
- So, City of Zug would have to adapt certain subordinate regulations if necessary.
- But as soon as it becomes clear that the City of Zug wants to use such a solution for e-voting, City of Zug would have to involve the whole political process and even initiate a popular vote.
- That would then certainly be a bigger story. Which it would be. Of course, the City of Zug can only be active in areas where it has sovereignty as a city. As soon as it comes to issues that affect higher-level cantons and the federal government, other bodies have to be involved and the more complicated things become, of course.

INTERVIEWER: And did you or do you have planned activities to prepare users of your digital identity solution and other stakeholders to use your blockchain solution? So, was there any training or briefing in that direction?

CITY OF ZUG:

- We have simply always, whenever we have done something new, we have explained and communicated it via Internet. But in most cases it was self-explanatory.

INTERVIEWER: And do you notice issues of acceptance among users?

CITY OF ZUG:

- Yes. One acceptance problem that City of Zug has identified is that City of Zug is working on an open solution, as you have identified. For example, with uPort together, so the app is a solution of uPort and there you have to accept terms and conditions which are in English which indicate a place of jurisdiction in America. (…)

INTERVIEWER: Can you somehow outline the framework conditions you envisage for this later definitive solution? So, when you say "we would like to have different framework conditions", I ask myself as a researcher, what could that be for you?

CITY OF ZUG:

- So, one possibility would be, of course: In Switzerland, a so-called e-ID law has been passed, where the federal government specifies how it envisages these electronic identities in the future.
- The federal government now focuses very strongly on private providers and semi-private providers such as our Federal Railways and the Post Office and so on. And the city says: "we as municipalities can do it better". They are already identity service providers today and, for example, different cities are joining forces and saying "we are issuing our own such identity".

INTERVIEWER: What do you think you can do better as a municipality than a private company?

CITY OF ZUG:

- On the one hand, from experience. The City of Zug is already an identity service provider today, others have yet to become one.

- What is very important: independence. I am convinced that the public sector offers a greater guarantee of independence than if a private company were to issue identities.
- Especially because I am convinced that electronic identities will play a much greater role in the future than physical ones, ID cards and passports and so on. It can't be there when the private companies issue these digital identities afterwards.
- They say "yes, the data will not be misused" and so on, but the step is very, very small, that even if it is on a voluntary basis, for example the Bundesbahn will issue such identities. Then they can suddenly say "Yes, if you provide us with your travel data, you will get a ten percent discount on a ticket".
- Even if this is voluntary to a certain extent, it does lead to private individuals using data afterwards. City of Zug can offer greater independence as a municipality.

INTERVIEWER: Probably even with your own interest in the data, you will probably have quite different interests from those of private companies. (CITY OF ZUG: Yes, exactly.) We've been through the questions. Do you have any questions for me now?

CITY OF ZUG: No, if I may, I would simply be interested in your thesis, because I find it exciting to read something else as well. And so, I would be happy if you could send me something, if you may, or can.

INTERVIEWER: I certainly may. I suppose if I look at my schedule now, it should at best be at the end of the first quarter, maybe in the second quarter of next year. I have written this down, I will simply send it to you by e-mail.

A4.6 Interview analysis

Dimension (Baccarini 1999)	NPG core element	None		
	Category of subject	**Motivation**		
	Project	Malta	Zug	Sweden
Input (out of scope)	Statement	- Learning Machine as blockchain provider - Wanted to move and demonstrate something quickly - Decision to go for blockchain on working level first, before government of Malta was interested	- Various partners involved in project: University, Ethereum, uPort, City of Zug, citizens (test users) - Involved citizens (test users) already participated in other innovative initiatives before	- Project partners were banks, sellers and buyers, technical consultants
Output	Statement / Finding	- Nation-wide blockchain educational credential solution - Issuer software and app for citizens as output products - Pilot status, but in production - Download app, activate private key and everything is working - Built on BlockSet Open Standard (Bitcoin open standard and open source) - Public permissionless blockchain - "That solution is starting to become the norm" - Solution has off- and on-chain components - Off-chain certification database of institutions as a project deliverable	- Local solution for digital identity - Pilot status, project not completed - Pilot solution is an interims solution - Ethereum-based solution	- National solution for selling and buying properties - Transfer of land title; facilitation of transactions - Proprietary private permissioned blockchain solution - Two components developed: smart contract workflow, blockchain workflow - (Smart) contract workflow engine to "automatically process transactions of participants" - Solution is not in production, Proof of Concept (PoC) only - "Small-scale, production-like blockchain solution"

Dimension (Baccarini 1999)	NPG core element	None		
	Category of subject	**Motivation**		
	Project	Malta	Zug	Sweden
				- Five nodes only, "not so many" - "Finally recorded some steps of the process to the blockchain" - Solution has off- and on-chain components
	Interpretation	- Rather small-scale solutions, focusing on either one or only a few public services --> less potential for gaining experience with connected public services - Early projects (PoC, pilot) and thus, probably less experience with having blockchain-based public service running - National & local public services in scope - Partly proprietary and open standard-based solutions		
Purpose	Statement / Finding	- Blockchain is based on identity and trust	No statement / finding	No statement / finding
	Interpretation	No interpretation feasible		
Goal	Statement / Finding	No statement / finding	No statement / finding	No statement / finding
	Interpretation	No interpretation feasible		

Dimension (Baccarini 1999)	NPG core element	Voluntary Co-Producing Networks		
	Category of subject	**Co-Production**		
	Project	Malta	Zug	Sweden
Input (out of scope)	Statement	No statement	No statement	- Would be more effective for society if blockchain transaction system was used, instead of paper-based organizations
Output	Statement / Finding	- Find human need/problems before starting a pilot - Rather centralized approach nonetheless - Different communication strategy when it comes to citizens - Switch of ownership of data difficult to understand for public institutions - "Many governments" do not like to lose control --> decentralization "not sexy" - Replicated the real world as closely as possible - You have to start with the same process, then transform it - No alignment to GDPR yet, "no matter what they tell you". However, requirement is often communicated as "met" - Users can decide if they want to use blockchain-based process or conventional process	- "Stakeholders [companies/citizens] are already involved in the design of new processes" - "We already have a very cooperative and open administration" - Data ownership changes due to implementation of eID service: from public administration to externals (citizens) - Process design should remain in own hands - Solution to authenticate for e-government services and to share personal data with 3rd parties - "Proof of residency" as a test service - Available services with blockchain-based digital ID: eVoting and bike renting - No regulatory hurdles perceived because pilot project only - Without "pilot project status" branding, "so many hurdles" would probably have been	- Switch of tasks from one role to another cannot be imagined --> "rare that you can finance or purchase a property yourself without involvement of a bank" - Adjusted the actual "business process" if necessary; but there was not much to change --> no process steps to be deleted - Instead of paper contracts/documents, "digital contract agreements" were used - Blockchain for verification process steps only - Disintermediated notaries - Five actors for workflow: buyer, seller, real estate agent, bank and land registry - Missing regulatory framework forces project to use private blockchain - Regulatory framework would allow "us to be distributed partners or existing in ecosystem without centralized feature"

Dimension (Baccarini 1999)	NPG core element	Voluntary Co-Producing Networks		
	Category of subject	**Co-Production**		
	Project	Malta	Zug	Sweden
			present - Regulatory hurdles manageable as long as blockchain solution is only add-on for existing option - Current federal law on eID stands in contrast to own [local] view (private service provider vs. competencies of municipalities) - Coverage by blockchain, where public administration acts as intermediary or as confirmation function - No field of application has yet been identified for sovereign administrative tasks - Replace existing electronic identity solutions, but otherwise only add-on/ simplification - Frontend portal as off-chain component	- Only some steps of the process are on-chain - Developed "contract engine" outside the blockchain - "Swedish land registry" is off-chain system - "Identifying (personal) data is stored off-chain" - API for legacy systems developed (e.g. to banks)
	Interpretation	- Replication of existing/non-NPG processes not helpful for allowing co-production - Ownership change (2 out of 3 projects) may support collaboration without government participation, i.e. decentralization - Projects did touch public services, showing a mindset which could be beneficial for co-producing networks - Blockchain usage obviously did not change much the way of working with other stakeholders --> but can when looking to Sweden with elimination of notaries - Most public administrations did not feel the need / necessity for drastic process changes		

Dimension (Baccarini 1999)	NPG core element	Voluntary Co-Producing Networks		
	Category of subject	**Co-Production**		
	Project	Malta	Zug	Sweden
		- Missing GDPR could hinder opening up networks completely - Closed pilot projects may be beneficial (due to legal challenges) to learn about functional possibilities/potentials - Users can always use traditional process, no replacement of older process. This may reduce the incentive to switch to blockchain-based public services - Not everything of a business process can be/will be put on blockchain. This may increase the complexity of the public service landscape - No big bang, but constantly growing network of participants (with the exception of Sweden approach) - Decentralized components of the business process which is benefitial for NPG in the sense of collaboration without goverment participation - Did not leverage additional non-public resources significantly. Instead, rather used same resources more efficiently		
Purpose	Statement / Finding	- Whether it is good for the citizens was up to the project lead / accelerator - Explain blockchain plans to major stakeholders of public institutions and explain impact on their area of work - Change of mindset of public stakeholders difficult for them --> "ownership of data" - Persuade decision makers that blockchain fits their strategies --> make it their project - Benefits of blockchain for eduction not recognized initially, instead Crypton was hyped - The project thought about decentralization - Citizens played minor role in the first place as this was more of a internal alignment	- Citizens have more self-determination/autonomy through changed data ownership - "E-Voting without a central administration" - Citizens control own data - Not only physical, but also digital identification - Lower administration cost - Lower storage cost on public administration site - Efficiency gains for citizens: time savings with respect to access to public services	- Project was aware of blockchain's potential to change role of public administration - Public service process basically remained the same, but became more efficient - "Guarantee" required for society in the end; "you place us as that guarantee" - No citizens involved because "too difficult" to involve and no interest group available - "new blockchain-based workflow that streamlines and secures the process of transferring a property title" - "For citizens, no need for a physical presence in the bank or at notary" - Improved mortgage handling

Dimension (Baccarini 1999)	NPG core element	Voluntary Co-Producing Networks		
	Category of subject	**Co-Production**		
	Project	Malta	Zug	Sweden
		- Lower administration costs - Citizen benefit: Convenient storage and selective sharing --> Self-Souverignity		- Project "to redefine real estate transactions and mortgage deeds" - Increased transparency and security of transactions
	Interpretation	- Purpose to key stakeholders was not obvious at the beginning and had to be communicated - Limited involvement of end users may decrease the potential of solution - Limited purpose in the sense of NPG as actual business process remained largely the same --> "no thinking big" - Efficiency gains on public and non-public side - Blockchain solution did provide efficiency gains, not surprising however: lower admin costs, faster handling, less physical appearance - Trust of citizens and businesses increased - Increased trust in official/public data - Orchestration of two similar processes for same purpose needed. Downside: increased complexity/effort, when additional solution is introduced, maybe adding effort to manage both ways		

Dimension (Baccarini 1999)	NPG core element	Voluntary Co-Producing Networks		
	Category of subject	**Co-Production**		
	Project	Malta	Zug	Sweden
Goal	Statement / Finding	- Blockchain is now not changing public administrations' work as an intermediary --> "it will later" - Custom-built may only work for small cases only - It still needs inspired leaders - Skill set for business managers change agents are missing to bridge both worlds - Public administrations want to keep control - Solutions allow stronger citizen/stakeholder independence from public administrations (less physical touchpoints with offices or communication with public administration) - Legislation for FinTech has been introduced - Whether solution is compliant to GDPR is perceived as a matter of interpretation (of law) - EU commission is expected to deliver answers - to solve this GDPR "disconnect" - Tipping point in the future: when not talked about blockchain anymore - Give citizens control over their educational	- For larger blockchain projects, referendum may also be necessary	No statement / finding

Dimension (Baccarini 1999)	NPG core element	Voluntary Co-Producing Networks		
	Category of subject	**Co-Production**		
	Project	Malta	Zug	Sweden
		credential records - Increase trust in educational credentials for private and public institutions - Next step: all public records on blockchain - Final objective is to have every eduction institution in Malta using that blockchain solution - System "could be extended to include multiple types of certificates"		
	Interpretation	- Minor impact in the sense of NPG due to minor scope of public service - Understanding and intention to make public administrations "one player amongst others" is largely missing - Mostly not changing the role of public admininistrations, but partly becomes a trusted broker for public data - Public administration/government needs to want and drive that change obviously - Wide-spread usage of blockchain depends on solving open GDPR issues		

Dimension (Baccarini 1999)	NPG core element	Voluntary Co-Producing Networks		
	Category of subject	**Voluntariness**		
	Project	Malta	Zug	Sweden
Input (out of scope)	Statement	No statement	No statement	- Stakeholders had to pay ("price tag") to participate in project - Had incentives for stakeholders to participate in the project - No incentives directly from public administration but triggered from engaged consulting firm
Output	Statement / Finding	- You have to persuade people - No incentives for citizens yet; short letter informing the graduate about the app offering - Incentives for public organizations: a) listen to your boss; b) give them "photo opps" - People will think of app, not of blockchain - Most important about innovation: when people don't talk about it - In public sector, it is perceived to be difficult to start off something new - "driven by the economic incentives of the issuers"	- Incentives play a minor role - Concrete and practical use cases for a solution must exist	- Technology and process focus only
	Interpretation	- Partly aware that they have to persuade people but did not pay much attention on incentives next to explaining their use cases - Incentives to use solution focused on functional benefits (use case) only --> no monetary incentives or similar - Technology & process focus only basically - Incentives for business involved in project were for PR purposes and to gain experience --> no pressure - Later incentives for business rather lie in efficiency gains		

Dimension (Baccarini 1999)	NPG core element	Voluntary Co-Producing Networks		
	Category of subject	**Voluntariness**		
	Project	Malta	Zug	Sweden
Purpose	Statement / Finding	- No need to walk into a government office anymore - Academic institutions have little economic reason to change from working with centralized solutions - Dealing with blockchain was a lucky coincident	- Less need for separate identification to use public service --> decreased effort - Gain experience outside the field of crypto-currencies - Gain access to companies and to experience their needs - Want to understand the possibilities of blockchain solutions - Exchange between public administrations	- "Everyone was there for their private interest": to earn some credit, become famous, gain experience - Prove that blockchain could work for the process of selling and buying property - "To show it was possible"
	Interpretation	- Lacking motivation / less reasons to persue others partly impacted the range of improvements for stakeholders/clients - Lacking incentives rather impacted the will to share responsibilities than to change the business process - When stakeholders participated in the project, not because to improve social situation in the first place but because of own interests (e.g. PR, financials, learning experience) - Public administrations partially used blockchain to see what is possible and not to address a particular issue		
Goal	Statement / Finding	- Some people say they will wait for what is going to happen - Pressure/force from government to use it since government is the sponsor - Some CxO believe blockchain will go away - Malta has a legacy as an innovative island: "let's go first'	- "Want to show that alternatives to central ID solutions exist" --> Putting citizens at the center - History as an innovator for crypto currencies or innovation center	- Explore the technology and the use for own purposes as public entity with responsibility to keep/maintain public registers - to drive legal development on digital contracts
	Interpretation	- Limited use of incentive strategies by public administrations may reduce the number of users/participants - Raises question whether incentives need to come from public administration or whether incentives of non-public actors could lead to an increasing use of this blockchain solution that implements a public service		

Dimension (Baccarini 1999)	NPG core element	Inter-Organizational Governance		
	Category of subject	**Institutional governance**		
	Project	Malta	Zug	Sweden
Input (out of scope)	Statement	- Offering for every public institution to join pilot but no hesitation was allowed	No statement	No statement
Output	Statement / Finding	- Offer to join to public and private education institutions was extended gradually - Blockchain solution became "a political thing" later - "Radical leadership" required ("you have to have this") - Public stakeholder ecosystem is very political - Top-down approach preferred and voluntariness leveraged - "Many governments" do not like to lose control: decentralization "not sexy"	- Perceives no change in the way the administration exchanges information with stakeholders - Exchange between stakeholders outside the administration is changing - City registration office has admin rights to blockchain solution - "Process design should remain in own hands"	- Switch of tasks from one role to another cannot be imagined: "rare that you can finance or purchase a property yourself without involvement of a bank" - Joint process design effort on detailed level
	Interpretation	- Importance of public administration as coordinator and driver fits to NPG perception on strategy level - No joint process design --> public administration remains in charge - Possibilities to / Potential of Monitor/Evaluate phase based on blockchain not of major importance (only for Sweden with central DB) - Blockchain usage obviously did not change much of the way of interacting with other stakeholders througout the public service delivery process --> but can as proven by Sweden by eliminating notaries - Business process involves stakeholder legacy systems raising questions on suitable governance frameworks		

Dimension (Baccarini 1999)	NPG core element	Inter-Organizational Governance		
	Category of subject	**Institutional governance**		
	Project	Malta	Zug	Sweden
Purpose	Statement / Finding	- Efforts in Ministry of Education not fully aligned/transparent to other governmental bodies - No significant decision-making support further than simply providing/offering blockchain-hosted data	- Public administration as a greater guarantee of independence than private companies - Decision-making processes can be secured and digitized through blockchain (e.g. voting)	- Process relies on off-/on-chain components along the way
	Interpretation	- Trust is still perceived to be delivered/garantueed by independent organizations and not technology (i.e. blockchain) - Because not everything is put on blockchain, the paradigm of "quality of the input impacts quality of the output" applies and ultimately influences the level of trust --> adequate governance mechanism need to consider how high quality of input can be ensured - Value of solution will increase gradually with the number of participating public institutions --> at the same time, this likely increases the governance effort - Alignment between "project" and other activities leaves room for improvement --> Alignment may be important to find right project scope		
Goal	Statement / Finding	- Need to manage "human networks" when trying to build nation-wide application - Government (executive level) enforces the use of blockchain, but working level specifies their individual requirements - Public administrations want to keep control	- Idea of City of Zug: Building something together with other Swiss cities later	- No change in roles expected, but they could be automated in the future - Don't see a change in roles within the next 15 years because of blockchain

Dimension (Baccarini 1999)	NPG core element	Inter-Organizational Governance		
	Category of subject	**Institutional governance**		
	Project	Malta	Zug	Sweden
	Interpretation	- Not really empowering stakeholders with respect to entire public service delivery process, especially citizens on design level --> thus, not much increased equality between public administrations and their stakeholders - Stronger focus on changing organization, especially roles, for blockchain projects required to unfold more potentials of NPG - Partly increasing the relationship as blockchain principles require "network thinking"		

Dimension (Baccarini 1999)	NPG core element	Inter-Organizational Governance		
	Category of subject	**Technical governance**		
	Project	Malta	Zug	Sweden
Input (out of scope)	Statement	- IT provider was able to learn "along the way"	No statement	No statement
Output	Statement / Finding	- Even a decentralized approach requires a IT supplier - Closed and hybrid blockchains more interesting for public administrations to keep control - Flexible communication process with IT provider useful for quick changes in development - Hash is on the blockchain, then stored on the cloud (AWS as provider) - Development decisions lie solely with the public administration - Chief sponsor, i.e. government, is making the decisions on changes - was, is and remains responsible	- The responsible decision-making authorities is linked to effects on costs - Defined rules contractually regulated for all external parties working on blockchain - Development decisions lie solely with the public administration	- Nodes hosted by partners (each of them) - "How do you decide on changes to the blockchain solution?" - Who is responsible for the Ethereum protocol? (i.e. is Ethereum Ltd. deciding alone on changes to its solution?) - Who is responsible for any "wrongdoing"? No one else but public entity - Not everyone should have the vote to decide on changes, "especially in the private blockchain" - "Everything is thought and introduced by someone" - "Someone needs to be responsible for the protocol" - They tried to find answers on how to share responsibilities but were not able to find them - Who should decide on changes to the blockchain is not answered yet

Dimension (Baccarini 1999)	NPG core element	Inter-Organizational Governance		
	Category of subject	**Technical governance**		
	Project	Malta	Zug	Sweden
				- "Cluster of nodes belonging to the Swedish Land Title Registry"
	Interpretation	- Public blockchain used partly, raising questions on impact of changes, like hards forks, on solutions running on those public blockchains - Made independent design decisions on blockchain architecture in order to keep control due to lacking overarching framework on blockchain governance --> directly impacting the design of business process - Decision making process partly based on cost only, demonstrating missing understanding of impact of changes to blockchain for public administrations, citizens, etc. - How to share responsibility on blockchain's technical level is not finally solved		
Purpose	Statement / Finding	No statement / finding	No statement / finding	No statement / finding
	Interpretation	No interpretation feasible		

Dimension (Baccarini 1999)	NPG core element	Inter-Organizational Governance		
	Category of subject	**Technical governance**		
	Project	Malta	Zug	Sweden
Goal	Statement / Finding	- "Whole new ecosystem" is coming in - Education of accountants/ professionals is necessary in the future to take over tasks of today's providers - Project is not sure if public administration or private sector could take over - Alignment between countries in EU Blockchain Partnership difficult due to individual settings/processes - Blockchain will be embedded in other solutions - A lot of people wait for Microsoft, SalesForce, IBM to come in to provide desired level of trust in intermediary	- Pilot projects working independently make it difficult to spread the blockchain technology	- Need "some sort of framework of responsibilities" - but there is none - As a public entity, how to ensure (functional/public) responsibility when not able to influence development of 3rd party components? - Best example for such a framework is EU initiative on European Blockchain Infrastructure (EBI), because EU is a very good distributed network - Regulation or the protocol for blockchain has to be made up by someone - How to make changes to blockchain is important question for all communities - Currently, all nodes lie within "participating partners", banks/brokers may become host nodes; citizens will not
	Interpretation	- Missing regulation hinders more wide spread solutions which could support the achievement of NPG goals - Regulation needed to define roles and especially responsibilities of involded parties because power/performance of providers is even more important for blockchain-based public services - Regulation is needed to find ways on who agrees on the architecture, governance, and solution changes/design		

Dimension (Baccarini 1999)	NPG core element	Inter-Organizational Governance		
	Category of subject	**Technical governance**		
	Project	Malta	Zug	Sweden
		- Technical standards on blockchain may only be accepted if proper regulation is in place - Blockchain usage demands more sophisticated relationship management, and widens the scope and importance of stakeholders management due to dependencies on technical network		

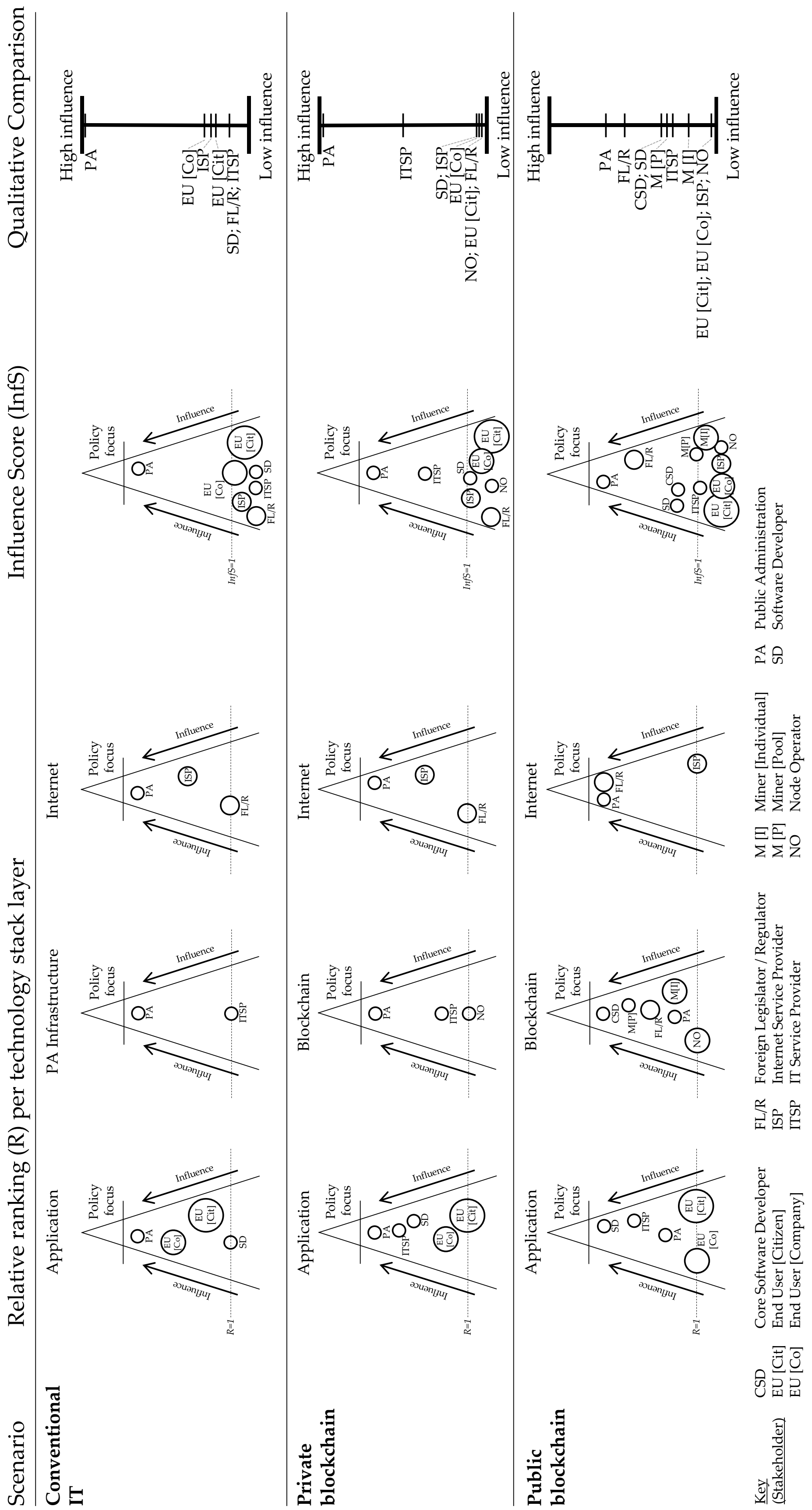
Dimension (Baccarini 1999)	NPG core element	Contract & Trust-Based Management		
	Category of subject	**(Smart) Contracting**		
	Project	Malta	Zug	Sweden
Input (out of scope)	Statement	No statement	No statement	No statement
Output	Statement / Finding	- No smart contracts used at the moment - Project thought about smart contracts	- No smart contracts used at the moment according to interviewee - However, technical documentation of leveraged 3rd party solution shows that the ID is a public address of a smart contract on the Ethereum blockchain - Two smart contract types in place: Controller contract and identity contract	- Smart contracts were used as part/extract from the so-called "contract engine" - "Blockchain in itself is not smart": it is a very logical transaction - Used for already formalized cases/processes
	Interpretation	- Smart contracts do not contribute significantly to collaboration on business process level - Negotiations take place outside the blockchain (with the exception of Sweden)		
Purpose	Statement / Finding	No statement / finding	No statement / finding	No statement / finding
	Interpretation	No interpretation feasible		
Goal	Statement / Finding	- "Techie guys" have that idea of automated ecosystem	- With Ethereum, using Smart Contracts would be feasible	- Roles (e.g. buyer, seller, identifier) could be automated in the future
	Interpretation	- There is strategic potential for the use of smart contracts since public administrations are largely aware of the possibilities of smart contracts or already leverage a blockchain technology that allows implementation of smart contracts		

Dimension (Baccarini 1999)	NPG core element	Contract & Trust-Based Management		
	Category of subject	**Informal processes**		
	Project	Malta	Zug	Sweden
Input (out of scope)	Statement	No statement	No statement	No statement
Output	Statement / Finding	- Public sector implies "formal" - Because solution represents copy of real-world: informalities and formalities of the real world are maintained	- Non-formalized processes are still needed - In general, less formalization is required for the advisory function of the administration	- "Nothing is never 1 or 0"
	Interpretation	- Apparently, the business processes did not become more formalized due to blockchain, rather in the sense of more efficient and connected - Informal elements of public service still exist and are not obsolete due to blockchain --> they are handled outside blockchain solution - Consequently, research on impact of informal information on formalized blockchain-based business process is important		
Purpose	Statement / Finding	No statement / finding	- Formalization important in legal proceedings	No statement / finding
	Interpretation	No interpretation feasible		
Goal	Statement / Finding	No statement / finding	No statement / finding	- When "everything" should be put on blockchain, then probably need to work with AI
	Interpretation	No interpretation feasible		

Dimension (Baccarini 1999)	NPG core element	Contract & Trust-Based Management		
	Category of subject	**Acceptance**		
	Project	Malta	Zug	Sweden
Input (out of scope)	Statement	No statement	No statement	No statement
Output	Statement / Finding	- Initially hesitant public institutions ("university") are joining now - Blockchain solution provider developed videos for end user training - Make blockchain topic less technologic and more user-centric - User acceptance issue: people are lazy, even to download the app - Complicated territory: make it simple	- Acceptance problems by using an "open solution", i.e. open source and external development (provider terms of condition, language and place of jurisdiction) - News always explained and communicated via the Internet, but usually self-explanatory	- No user acceptance issues experienced - Number of people involved in the project to test user interface & transaction process --> "good user experience" - The user should be able to use it without any user training: should be intuitive and user friendly
	Interpretation	- Projects leveraged different approaches to tackle user satisfaction - Citizens struggled to use solution as they were too lazy demonstrating the need for more sophisticated incentive strategies - Some users were "happy" because they participated in testing as part of the design process - Some people struggled to use solution due to uncertainty regarding their personal data use - Potential participants hesitated to join due to unfavorable incentives		
Purpose	Statement / Finding	No statement / finding	- "Microsoft" solution required for blockchain: easy to use, customer-friendly, "certain economies of scale"/ "can be copied"	No statement / finding
	Interpretation	No interpretation feasible		
Goal	Statement / Finding	- "We should educate people what is good for them" - University faculty to set up new organizational units for DLT - Educate professionals to new styles of working (and/or take over today's external provider work)	No statement / finding	No statement / finding

Dimension (Baccarini 1999)	NPG core element	Contract & Trust-Based Management		
	Category of subject	**Acceptance**		
	Project	Malta	Zug	Sweden
	Interpretation	- Further research needed if long-term strategy and multifaceted approach required for education to root the idea, benefits of the solution in mindset of people		

A5.1 Overview of influence maps



A5.2 Influence calculation

Comparison across scenarios

Relevant Stakeholder	Converted Influence Score		
	Conventional IT	Private blockchain	Public blockchain
Core Software Developer	/	/	0,33
Software Developer	0,11	0,21	0,33
End User [Citizen]	0,19	0,09	0,09
End User [Company]	0,26	0,15	0,09
Foreign Legislator / Regulator	0,11	0,09	0,55
Internet Service Provider	0,22	0,21	0,09
IT Service Provider	0,11	0,48	0,25
Miner [Individual]	/	/	0,15
Miner [Pool]	/	/	0,27
Node Operator	/	0,09	0,09
Public Administration	1,00	1,00	0,66

Scale: 0 = No relevance; 1 = High relevance

Scenario: Conventional IT | Average highest rank: 3,0

Relevant Stakeholder (Group)	Application		PA Infrastructure		Internet		Frequency Ranked	Influence Score
	R	Ra	R	Ra	R	Ra		
Public Administration	4,0	3,0	2,0	3,0	3,0	3,0	3	3,0
End User [Citizen]	2,0	1,7					1	0,6
End User [Company]	3,0	2,3					1	0,8
Software Developer	1,0	1,0					1	0,3
IT Service Provider			1,0	1,0			1	0,3
Foreign Legislator / Regulator					1,0	1,0	1	0,3
Internet Service Provider					2,0	2,0	1	0,7

Scenario: Conventional IT | Stack layer: Application | Highest ranking: 4

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
End User [Citizen]	Consumer of public service as provided by Public Administration	Biggest	2	Although the public administration is understandably interested in securing votes and saving tax money, it is rather difficult for End User [Citizen] to directly shape processes and solutions.	- Expect public good from Public Administration for their tax money [18] - More influence [17] - Avoid responsibility [17] - Less state involvement and increased independence [6] - Want policies to be implemented as planned [15]	- Vote his/her political authority - Tax payer
Public Administration	- Owner and provider of public administration - Partly leveraging own IT development capacities	Smallest	4	Most influence on policy by far due to public service and IT solution ownership; and larger possibilities to enforce changes to both.	- Shape/deliver public policy as perceived as [politically] needed [2] - Want other stakeholders to follow rules and pay tax [18] - Ensure democractic accountability [16] [8] - Seeks for stakeholders to compensate decline in resources [8] - (Re-)gain public trust/ citizen/Customer satisfaction [8] [19] - Want efficient public service delivery [19] [11] - Want stakeholders to participate collaboratively [5]	- Legitimacy of action through democratic election process [8] - Legal and regulatory power of own jurisdiction [8] - Can impose sanctions to others within the PA's jurisdiction to enforce standards [18], [3], law and regulation - Can force end users to use system due to missing alternatives (monopol) - Providing "the lion's share" of public regulation, goods, services, etc. [16]
End User [Company]	Consumer of public service as provided by Public Administration	Big	3	Domestic economic impact may drive public administration to define and adjust the offering in response to that.	- Expect public good from Public Administration for their tax money [18] - Influence (lobbying) [17] - Economic interests [9] - Beneficial regulatory framework	- Relationships and influence - Tax payer - Impact on domestic economy

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
Software Developer	Developing applications on behalf of Public Administration	Smallest	1	Only limited impact due to strong contractual dependence on public administration.	- Fulfill contract with public administration - Economic interest - Reputation [17]	- Scarce know-how and resources [17]

Scenario: Conventional IT | Stack layer: Public administration infrastructure | Highest ranking: 2

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
Public Administration	Providing internal IT infrastructure services for own needs, including data center and servers	Smallest	2	Higher influence on policy as ownership of most IT infrastructure components rests with this stakeholder. Contractual relationship with IT Service Provider can help to set rules of engagement, e.g. provider selection, changes to IT infrastructure.	- Seeks stakeholders to compensate decline in resources [8] - Want efficient public service delivery [19] [11]	- Legal and regulatory power of own jurisdiction [8] - Contractual relationship with IT Service Provider - Leveraging own IT capacities - Can independently decide on (fundamental) changes to solution
IT Service Provider	Providing IT infrastructure services, e.g. network or cloud services, to support IT of public administration	Smallest	1	Less influence, but public service can nonetheless depend on these IT services to run properly. Potential cloud services can increase influence on PA infrastructure.	- Economic interest - Experience - Reputation [17] - Fulfill contract with Public Administration - Influence (lobbying) [17]	- Scarce know-how and resources [17] - Solution integration complexity (migration efforts to switch to another IT service provider may chill Public Administration to change providers) - Partly, due to ownership of IT infrastructure, e.g. cloud services

Scenario: Conventional IT | Stack layer: Internet | Highest ranking: 3

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
Internet Service Provider	Provide "key access points through which Internet traffic can be controlled" [4]	Small	2	Influence comes with the ownership of network resp. access points and the stakeholders contractual relationship with End User [Citizen/Company]. Global orientation could cause conflicts between domestic and foreign regulation.	- Be compliant with various laws/regulation (highly regulated) - Economic interest	- Owning the access points that form the internet - Owning contracts with users, e.g. citizens or companies
Public Administration	Domestic public authority with legal and regulatory competencies	Smallest	3	As domestic authority, Public Administration could define the rules to e.g. support or secure the usage of this online available public service.	- Ensure access to and data from the Internet meets own legal or political agenda	- Law and regulation, e.g. to force to block or slow down data [4]
Foreign Legislator / Regulator	Non-domestic public authority with legal and regulatory competencies	Small	1	Could define regulation for Internet Service Provider which is also engaged abroad, with consequences to the public service. But can hardly enforce changes domestically.	- Ensure access to and data from the Internet meets own legal or political agenda	- Law and regulation, e.g. to force to block or slow down data [4]

Scenario: Private blockchain | Average highest rank: 3,7

Use case: *Swedish Mapping, Cadastral and Land Registration Authority – "Transfer of land titles"*

Relevant Stakeholder (Group)	Application		Blockchain		Internet		Frequency Ranked	Influence Score
	R	Ra	R	Ra	R	Ra		
Public administration	5	4	3	4	3	4	3	3,7
End User [Citizen]	1	1					1	0,3
End User [Company]	2	2					1	0,6
IT Service Provider	4	3	2	2			2	1,8
Software Developer	3	2					1	0,8
Node Operator			1	1			1	0,3
Internet Service Provider					2	2	1	0,8
Foreign Legislator / Regulator					1	1	1	0,3

Scenario: Private blockchain | Stack layer: Application | Highest ranking: 5

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
End User [Citizen]	Non-commercial buyer or seller of real estate	Biggest	1	Low involvement in the process design and maintenance but many End User [Citizen] could express dissatisfaction, if needed, to press for changes.	- Less state involvement, more independence from public actors [6] - Easy to handle process and technical solution - Get an approval/ confirmation of the real estate transaction [13] - Reliable data [1] - Expect public good from Public Administration for their tax money [18]	- Choice to use the blockchain-based or conventional solution - Vote his/her political authority
End User [Company]	Commercial buyer, seller or agent of real estate	Big	2	Rather low influence, but involved in the design process, in contrast to End User [Citizen]	- Get an approval/confirmation of the real estate transaction [13] - Reliable data [1] - Efficient business processes - Want to "co-govern" [17]	- Choice to use the blockchain-based or conventional solution

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
Public Administration	- Swedish public administration - Partner of consortium - Contract administrator	Smallest	5	Can drive the design process of the solution as it is accountable for the conventional solution and respective legal questions. Will ensure initial design and changes to the solution are in line with objectives of the public administration.	- Seek relationships with other stakeholder in order to solve complex problems [11] - Want stakeholders to participate collaboratively [5] - (Re-)gain public trust/ citizen/Customer satisfaction [8] [19] - Want End User [Citizen] to participate [17] - Efficient public service delivery [19] [11]	- Define and adjust regulations/law for own jurisdiction [8] - Owner of conventional solution; could replace conventional with blockchain-based solution and, thus, force end users to use blockchain-based solution
IT Service Provider	- Contract administrator and "the architects of the solution" [7], 61) - Provider of ID solutions	Smallest	4	Influence on public service because e.g. the stakeholder's resources are constantly required for running and maintaining the application and connecting services.	- Promote their business and brand name [1] - Economic interest [9] - Influence (lobbying) [17]	- Scarce know-how and resources [17]
Software Developer	Developer of the solution [7], 61)	Smallest	3	Rare knowledge of the proprietary application and may be difficult to replace, if required.	- Economic interest - Reputation	- Scarce know-how and resources [17]

Scenario: Private blockchain | Stack layer: Blockchain | Highest ranking: 3

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
Public Administration	Various functions: - Validator of blocks and transactions - Operator of public IT, e.g. database of lantmäteriet - Consortium partner - Maintain blockchain network	Smallest	3	Can drive the design process of the solution as it is accountable for the conventional solution and respective legal questions. Will ensure initial design and changes to the solution are in line with objectives of the public administration. Takes over priviledged responsibilities on blockchain level, e.g. operating a node or validate new blocks and transactions.	- Keep their legitimacy and capacity to regulate [8] [17] - Do not want to become obsolete [2] - Keep control from systems perspective [10] - Want to "meta-govern" [17] - Ensure further development of the blockchain network meets own legal or political agenda [4] - Support changes on this stack layer only if no negative consquences for its service/ application - Seek relationships with other stakeholder in order to solve complex problems [11] - Efficient public service delivery [19] [11] - Ensure democractic accountability [16] [8]	- Legal and regulatory power of own jurisdiction [8] - High reputation [7] - Confirm new nodes/partners - Authority to check and change blockchain network - Provide access and assign new nodes [12]
Node Operator	- Commercial consortium partner - Validator of blocks and transactions - Storage of blockchain data	Smallest	1	Takes over crucial role to run the blockchain network, but has only a limited voice when it comes to changes to the network.	- Economic interest - Keep reputation [17]	- Approved sufficient reputation - Sufficient number of diverse nodes required to fulfill purpose of consortium blockchain

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
IT Service Provider	- Commercial consortium partner - Maintain blockchain network	Smallest	2	Takes over priviledged responsibilities on blockchain level, e.g. operating a node or validate new blocks and transactions. Strongly engaged to (further) develop the network in favor for its commercial needs.	- Economic interest - Want to "co-govern" [17] - Influence (lobbying) [17]	- Scarce know-how and resources [17] - Solution integration complexity (migration efforts to switch to another IT service provider may chill Public Administration to change providers) - Authority to check and change blockchain network

Scenario: Private blockchain | Stack layer: Internet | Highest ranking: 3

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
Internet Service Provider	Provide "key access points through which Internet traffic can be controlled" [4]	Small	2	Influence comes with the ownership of network resp. access points and the stakeholders contractual relationship with End User [Citizen/Company]. Global orientation could cause conflicts between domestic and foreign regulation.	- Be compliant with various laws/regulation (highly regulated) - Economic interest	- Owning the access points that form the internet - Owning contracts with users, e.g. citizens or companies
Public Administration	Swedish public authority with legal and regulatory competencies	Smallest	3	As domestic authority, Public Administration could define the rules to e.g. support or secure the usage of this online available public service.	- Ensure access to and data from the Internet meets own legal or political agenda	- Law and regulation, e.g. to force to block or slow down data [4]
Foreign Legislator / Regulator	Non-Swedish public authority with legal and regulatory competencies	Small	1	Could define regulation for Internet Service Provider which is also engaged abroad, with consequences to the public service. But can hardly enforce changes domestically.	- Ensure access to and data from the Internet meets own legal or political agenda	- Law and regulation, e.g. to force to block or slow down data [4]

Scenario: Public blockchain | Average highest rank: 3,7

Use case: *Ministry for Education and Employment of Malta – "Issue and authenticate educational credentials"*

Relevant Stakeholder (Group)	Application		Blockchain		Internet		Frequency Ranked	Influence Score
	R	Ra	R	Ra	R	Ra		
Public Administration	2	1,9	2	1,7	2	3,7	3	2,4
End User [Company]	1	1,0					1	0,3
End User [Citizen]	1	1,0					1	0,3
Software Developer	4	3,7					1	1,2
IT Service Provider	3	2,8					1	0,9
Miner [Individual]			2	1,7			1	0,6
Miner [Pool]			4	3,0			1	1,0
Core Software Developer			5	3,7			1	1,2
Foreign Legislator / Regulator			3	2,3	2	3,7	2	2,0
Node Operator			1	1,0			1	0,3
Internet Service Provider					1	1,0	1	0,3

Scenario: Public blockchain | Stack layer: Application | Highest ranking: 4

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
Public Administration	Maltese educational institution, e.g. university or MEDE; issuer of educational credentials	Smallest	2	Decide on the selection of open source software and experienced Software Developer and IT Service Provider. Once decided, Public Administration may struggle to implement or hinder changes as they are not in charge of the software's development lifecycle. Could decide to rollback to alternative/ conventional solution.	- Support changes from underlying blockchain layer only if no negative consquences for its service/ application - High degree of reliability, accessibility and predictability, being not tolerant of any service interruption or failure [1] - Enforce service design and implementation which meets own political agenda [4] - Want End User [Citizen] to participate [17] - Want stakeholders to participate collaboratively [5] - (Re-)gain public trust/ citizen/Customer satisfaction [8] [19]	- Define and adjust regulations/law for own jurisdiction [8] - Owner of conventional solution; Could replace conventional with blockchain-based solution and, thus, force end users to use blockchain-based solution
End User [Company]	National or international company or organization which relies on educational credentials of employees or partners	Big	1	User of the application that needs to be convinced to use it, because no coercive use is planned. However, there are decision rights linked with this stakeholder.	- Efficient business processes - Improved trust in data of applicants [13] - Want to "co-govern" [17] - Economic interest [9]	- Choice to use the blockchain-based or conventional solution

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
End User [Citizen]	Graduated person	Biggest	1	User of the application that needs to be convinced to use it, because no coercive use is planned. However, there are decision rights linked with this stakeholder.	- Less state involvement, more independence from public actors [6] - Easy to handle process and technical solution - Widely accepted and easily accessible educational credentials for interested company/organization - Expect public good from Public Administration for their tax money [18]	- Choice to use the blockchain-based or conventional solution - Vast number of end users makes it harder to influence the stakeholder group [4]
Software Developer	Open Source Community of Blockcerts open standard	Small	4	Open Source Community finally and independently decides on changes to the solution and, thus, drives the further development.	- Promote their business and brand name [1] - Economic interest - Follow processes and rules of the open source community [3] - Develop a solution that softens the dependence on public actors	- Solution integration complexity (migration efforts to switch to another IT service provider may chill owners to change providers) - Scarce know-how and resources [17] - Decide on changes to the source code
IT Service Provider	Providing website to End User [Company] for verification of educational credentials ("Blockcerts Universal Verifier")	Smallest	3	Provides fundamental service (verification of issued certificates) and is closely linked to Software Developer as both belong to the Blockcert solution.	- Wants failure-free website operation - Economic interest - Promote their business and brand name [1]	- Solution integration complexity due to all-in-one solution approach - Scarce know-how and resources [17]

Scenario: Public blockchain | Stack layer: Blockchain | Highest ranking: 5

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Result (estimated)	Direction of interest	Bases of Power
Public Administration	- Maltese public administration - Participate in votings as tokenholder	Smallest	2	Great interest in further development of blockchain network but very limited capacities to make an impact on this development. Impose legal obligations on influencial stakeholders of this level are limited because these stakeholders are largely outside the domestic jurisdiction.	- Keep their legitimacy and capacity to regulate [8] [17] - Do not want to become obsolete [2] - Keep control from systems perspective [10] - Want to "meta-govern" [17] - Ensure development of the blockchain network meets own legal or political agenda [4] - Support changes on this stack layer only if no negative consquences for its service/ application - Seek relationships with other stakeholder in order to solve complex problems [11] - Want efficient public service delivery [19] [11] - Ensure democractic accountability [16] [8]	- Tokens to vote - Law and regulation to influence stakeholders within their jurisdiction [4]
Miner [Individual]	Create new blocks	Big	2	An individual miner would struggle immensely to induce change, but can make a difference in conjunction with other miners [Individual / Pool].	- Economic interest - Interested in technology (tech enthusiasts) - Develop blockchain network in its favor [10] - Be compliant with miner's domestic law and regulation [3]	- Computing Power - Tokens to vote

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Result (estimated)	Direction of interest	Bases of Power
Miner [Pool]	- Create new blocks - Combined capacities to increase amount of blocks and, thus, earn more transaction fees	Smallest	4	Powerful stakeholder due to huge economic interest (transaction fees) in blockchain network and the vast amount of tokens a miner [Pool] holds, which gives him/her voting power. Can make the decision to (not) implement changes approved by Core Software Developer as they hold a large amount of tokens. Could be influenced by their domestic legislator / regulator but could finally move to a more mining-friendly jurisdiction.	- Economic interest - Keep costs for hardware [4] and power consumption low - Mining-friendly law and regulation - Develop blockchain network in its favor [10] - Be compliant with miner's domestic law and regulation [3]	- Computing power - Rather mobile and thus, not necessarily bound to domestic jurisdication [4] - Tokens to vote - Voting power due to high number of tokens [4] [14] [3]
Core Software Developer	- Maintain Bitcoin network - Manage changes and evaluate Bitcoin Improvement Proposals (BIP)	Smallest	5	Can rather independently decide on improvement proposals and initiate votings. Hardly controllable because Core Software Developer is an individual and not an organization. Additionally, most Core Software Developer are situated in various jurisdictions, making it unlikely to impose legal rules from one particular jurisdiction.	- Further development of blockchain network	- Different jurisdictions among core software developers [4] - Can evaluate and accept BIP and decide on starting a vote [4] [1] - Rather intransparent and not formalized decision-making rules for changes [4]

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Result (estimated)	Direction of interest	Bases of Power
Foreign Legislator / Regulator	Non-Maltese public organizations worldwide	Small	3	Foreign Legislator / Regulator could use its legal capacities to regulate other stakeholders within its jurisdiction. Past events have shown that this applies to China and Miner [Pool] in particular. But could become valid whenever a larger group of stakeholders cumulate in one jurisdiction. However, the Foreign Legislator / Regulator may have other reasons or services but the Maltese public service in scope to define regulations affecting this blockchain network.	- Ensure development of blockchain network meets own legal or political agenda [4]	- Law and regulation to influence (powerful) stakeholders within their jurisdiction [4]
Node Operator	- Store blockchain - Validate new blocks - Here, without mining intentions	Big	1	Can hold a high number of tokens. Also, particular important to fulfill basic functionalities of the blockchain network, i.e. storing blockchain data or validate new blocks.		- Tokens to vote [4] - High number of tokens [3]

Scenario: Public blockchain | Stack layer: Internet | Highest ranking: 2

Relevant Stakeholder (Group)	Description	Group size	Relative Ranking	Power / Influence		
				Assessment	Direction of interest	Bases of Power
Internet Service Provider	Provide "key access points through which Internet traffic can be controlled" [4]	Small	1	Influence comes with the ownership of network resp. access points and the stakeholders contractual relationship with End User [Citizen/Company]. Global orientation could cause conflicts between domestic and foreign regulation.	- Be compliant with various laws/regulation (highly regulated) - Economic interest	- Owning the access points that form the internet - Owning contracts with users, e.g. citizens or companies
Public Administration	Maltese public authority with legal and regulatory competencies	Smallest	2	As domestic authority, Public Administration could define the rules to e.g. support or secure the usage of this online available public service.	- Ensure access to and data from the Internet meets own legal or political agenda	- Law and regulation, e.g. to force to block or slow down data [4]
Foreign Legislator / Regulator	Non-Maltese public authority with legal and regulatory competencies	Small	2	Could define regulation for Internet Service Provider which is engaged in the jurisdiction of the Foreign Legislator / Regulator with consequences to the public service. But can hardly enforce changes domestically. However, the Foreign Legislator / Regulator may have other reasons or services but the Maltese public service in scope to define regulations affecting the Internet Service Provider.	- Ensure access to and data from the Internet meets own legal or political agenda	- Law and regulation, e.g. to force to block or slow down data [4]

References within calculation

No.	References
[1]	Atzori (2015)
[2]	Christensen and Lægreid (2012)
[3]	Filippi and Mcmullen (2018)
[4]	Finck (2019)
[5]	Innes and Booher (2004)
[6]	Katsamunska (2016)
[7]	Kempe (2017)
[8]	Liddle (2018)
[9]	Malito, Umbach, and Bhuta (2018)
[10]	D. Meijer and Ubacht (2018)
[11]	Moynihan et al. (2010)
[12]	Ølnes et al. (2017)
[13]	Pignatelli et al. (2019)
[14]	Rozas et al. (2018)
[15]	Torfing, Peters, Pierre, and Sørensen (2012b)
[16]	Torfing et al. (2012c)

No.	References
[17]	Torfing et al. (2012d)
[18]	van Waarden (2012).
[19]	Wiesel and Modell (2014)

OVERVIEW OF CHANGES TO THE PREVIOUS VERSION

Zur angemessenen Berücksichtigung des Beschlusses des Promotionsausschusses wurden Änderungen an dieser Dissertationsarbeit vorgenommen, die nachstehend zusammenfassend aufgeführt werden.

„1) Der in Kapitel 2 der Arbeit enthaltene Artikel ist aus der Dissertationsschrift zu entfernen."

- Der betroffene Artikel „Can Blockchain Leverage for New Public Governance? A Conceptual Analysis on Process Level" ist nunmehr kein essenzieller Bestandteil dieser Dissertation. Er wird lediglich der Vollständigkeit wegen als Anhang A3.1 zur Information angeboten.

„2) In die Arbeit kann stattdessen eine weitere Forschungsarbeit aufgenommen werden."

- Der Artikel in Kapitel 3 dieser Dissertation wurde überarbeitet und sein vormals theoretischer Charakter durch eine empirische Ausrichtung gestärkt. Aus methodischer Sicht wurde dazu innerhalb des Artikels einerseits ein initiales fallbasiertes Assessment und andererseits eine Delphi-Studie zur Ergebnisvalidierung durchgeführt.

„3) Die in der Arbeit enthaltenen Schriften (sowie das Übersichtspapier und die Zusammenfassung) sind dahingehend zu überarbeiten bzw. zu ergänzen, dass ‚die verwendeten Methoden zur Lösung der Aufgaben in nachvollziehbarer Weise' beschrieben werden"

- Die gewählten Methoden wurden in Kapitel 1 insbesondere im Rahmen des *Research Designs* (Abschnitt 1.2) zusammenfassend aufgeführt und den Artikeln zugeordnet.

- Mit Abschnitt 2.3 (*Current state of research*) wurde die Methodenauswahl auch in den Kontext des aktuellen Stands der Forschung gesetzt.
- Jedes, ein Artikel enthaltenes, Kapitel wurde um einen abschließenden Abschnitt ergänzt, der die verwendeten Methoden benennt und deren damit erzielten Wertbeitrag beschreibt.

„4) Ebenso sind die in der Arbeit enthaltenen Schriften dahingehend zu überarbeiten, dass ihr jeweiliger Beitrag zur übergeordneten Fragestellung der Dissertation klar ersichtlich wird. Zudem sind die Resultate in Zusammenfassung mit dem relevanten gegenwärtigen Kenntnisstand zu interpretieren und diskutieren“

- Die Kapitel 1 (*Introduction*) und 2 (*Theoretical Foundations*) wurden derart aufgebaut, dass sie eine klare kausale Kette („Top-down“) vom relevanten Forschungsbedarf, über die Forschungsfragen bis zur Artikelstruktur darstellen sollen. *Figure 2* in Abschnitt 2.3 stellt die kausale Kette zusammenfassend dar.
- Jedes, einen Artikel enthaltenes, Kapitel wurde um einen abschließenden Abschnitt (*Contributions to overaching dissertation*) ergänzt, der den jeweils erzielten Wertbeitrag bezüglich des Forschungsbedarfs („Bottom-up“) beschreibt und die verwendeten Methoden erwähnt.
- Abschnitt 6.1 im Kapitel 6 (*Synthesis*) diskutiert den wissenschaftlichen Fortschritt der Dissertation im Hinblick auf die Forschungsfragen und den damit verbundenen Forschungsbedarfen zu Beginn der Dissertation. Mit den nachfolgenden Abschnitten, insbesondere die Abschnitte 6.3 und 6.4, werden weiterführende Forschungsbedarfe und -fragen aufgelistet.

„5) Die bislang zu Beginn der Kapitel aufgeführten Hinweise zum Publikationsstatus der Papiere sollten zu Beginn der kumulativen Dissertation in übersichtlicher Form zusammengeführt werden.“

- Abschnitt 1.4 (*Overview of articles and author contribution*) listet die drei Artikel auf, die dieser Dissertation zu Grunde liegen. Er liefert einen Überblick zum Publikationsstatus und beschreibt die wesentlichen Charakteristika hinsichtlich Inhalte und Methodiken.

„Gemäß §8(7) sind die formulierten Auflagen innerhalb eines halben Jahres zu erfüllen und in der dann einzureichenden geänderten Fassung der Dissertation nachvollziehbar zu dokumentieren."

- Dieser Abschnitt soll nachvollziehbar die Änderungen an der Dissertation dokumentieren, die der Erfüllung der formulierten Auflagen des Promotionsausschusses dienen.

EIDESSTATTLICHE ERKLÄRUNG

Ich versichere an Eides statt, dass meine hinsichtlich der früheren Teilnahme an Promotionsverfahren gemachten Angaben richtig sind und, dass die eingereichte Arbeit oder wesentliche Teile derselben in keinem anderen Verfahren zur Erlangung eines akademischen Grades vorgelegt worden sind.

Ich versichere darüber hinaus, dass bei der Anfertigung der Dissertation die Grundsätze zur Sicherung guter wissenschaftlicher Praxis der DFG eingehalten wurden, die Dissertation selbständig und ohne fremde Hilfe verfasst wurde, andere als die von mir angegebenen Quellen und Hilfsmittel nicht benutzt worden sind und die den benutzten Werken wörtlich oder sinngemäß entnommenen Stellen als solche kenntlich gemacht wurden. Einer Überprüfung der eingereichten Dissertation bzw. der eingereichten Schriften mittels einer Plagiatsprüfungssoftware stimme ich zu.

Potsdam, im November 2021

Maik Brinkmann