Application of Blockchain Technologies to Public and Governmental Affairs

Masterarbeit

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1. Introduction

1.1. Motivation and Relevance

Blockchain has been the buzzword of 2018 with seemingly unlimited use cases and application areas.[1] The German government has mentioned blockchain and distributed ledger technology in four different passages of their coalition agreement, specifically pointing out their intent to draft a blockchain strategy.[2]

By May 2018, global venture capital investments have surpassed the volume of 2017 with over 1.3 billion dollars while the Gartner Hype Cycle of Emerging Technologies has put blockchain at its peak of inflated expectations in July 2017.[3] At the same time, cryptocurrencies are being issued constantly with 915 ICOs that already took place as of July 1st, 2018, compared to an overall number of 872 in 2017 and 29 in 2016.[4]

Right now, everyone can feel the bonanza atmosphere while the fear of missing out is extremely high. The internet is potentially entering a new era, opening up untouched potential and changing firmly established structures of organizations which haven't been altered since the industrial age. Bitcoin and consequently the blockchain technology became famous for their state-of-the-art concept of cutting out intermediaries in a trustless consensus protocol.[5] Taking into consideration that public institutions and government agencies ultimately function as an intermediary between citizen and government, results in the important task for these institutions to find their spot in the currently evolving digital environment.

Projects like the UAE Blockchain Strategy 2021 of the United Arab Emirates with a projected saving potential of three billion dollars per year surface the big bets that are being put on blockchain technologies. Following official statements, blockchains are used to manage assets in every domain from tourism to vehicle registration and visa applications.[6]

Today over 100 governmental blockchain projects are being conducted in over 30 countries with the number steadily rising.[7] Although the number of projects is high, scientific research and proof of concepts in that field are scarce.

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[1] Cf. Busby, 2018
[2] Cf. Bundesregierung, 2018 p. 40 ff.
[3] Cf. Rowley, 2018; Panetta, 2017
[4] Cf. ICO, 2018
[5] Cf. Nakamoto, 2008 p. 2 ff.
[6] Cf. Alexandre, 2018
[7] Cf. Jun, 2018 p. 1

Due to the inhabited characteristics of these distributed ledger networks, application scenarios for governments in data handling infrastructures and secured data storages seem like an obvious choice. But there is more to it than just document and asset handling or digital money as the efforts of the UAE show.

This work is investigating current governmental blockchain projects globally while focusing specifically on two use cases. Furthermore, based on a qualitative empirical research design current developments especially in the German blockchain environment are taken into consideration, recommendations are given as well as upcoming challenges discussed.

1.2. Objective and Structure

While the interest for blockchain and its application forms in the financial and private sector are increasing, public and governmental institutions haven't been tapping into the full potential that the technical characteristics may hold for them. Current studies are mostly concerned with the explanation of core functions and the application for cryptocurrencies, such as Bitcoin. As suggested by Olnes et al., it is important that interdisciplinary research is undertaken in the field of potential governmental blockchain solutions in order to improve public services and solve associated problems like inefficiency, fraud or corruption.[8]

They are arguing for a more need-driven approach and a shift away from the current technology-driven research.

Decentralization is a new paradigm that emerges right now and which has to be understood in order to benefit from it. New regulations stir up uncertainty and to figure out what influences the implementation of solutions is as equally important to investigate as the challenges and opportunities that lie ahead so as to exploit the full potential of blockchains in this particular domain that is driven by caution. For doing so, the terms blockchain and distributed ledger technology are used equally in the course of this work. This is due to the main intend of the author to rather investigate and explore potential use cases that governments can benefit from instead of being constrained by terminological frameworks.

The research question investigated in this work therefore is:

„How and for what can blockchains be used in governmental and public institutions?"

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[8] Cf. Olnes et al., 2017 p. 355

This thesis is structured into six chapters, which build on each other in terms of content and methodology. Firstly, chapter 1 lays down the motivation and relevance as well as the objective and structure which is followed by this work. Following, chapter 2 creates a theoretical foundation for the respective fields of interest and chapter 3 displays the current status quo of research activities in this particular domain. This is accomplished at first through a systematical literature review before shedding light on global governmental efforts and use cases. This basis was taken into consideration before investigating the two case studies and possible industry solutions associated with them. Furthermore, due to current developments in the field, regulatory requirements imposed through the passing of the newly formulated EU-GDPR are included as well. The theoretical foundation and chapter 3 were taken into account for the set up of the interview guideline in order to create a theory and goal driven interview environment. As a next step, the methodological foundation, the data collection, the analytical process as well as the outcomes of the empirical research are explained in chapter 4. Finally, newly found information from the literature analysis as well as the qualitative research approach is discussed in chapter 5. For doing so, the research question and results are being examined through a critical lens. Furthermore, recommendations for action are being proposed and the limitations associated with this work presented. In the end, a conclusion is drawn and an outlook for potential future research topics is given.

1.3. Methodology

The main objective of this work is to dive down into blockchain applications for governments and public institutions worldwide in order to be able to make use of this innovative technology. For doing so, a literature review following Webster and Watsons' approach is conducted to display the current status quo of research activities in that domain. Subsequently, two use cases are presented in the form of two single case studies in order to give an impression about possible implementations of blockchains into governmental and public affairs. In Yin's perception, which is followed by this work, "[a] case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. [...] The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result

benefits from the prior development of theoretical propositions to guide data collection and analysis."[9]

The case studies are important so as to understand how blockchain technologies can help public and governmental institutions in increasing their efficiency, trust, and transparency to meet present needs of society while at the same time describing potential implementation approaches and hence drive awareness.

Guideline expert interviews are chosen as qualitative research approach due to the novelty of this application area and hence the unavailability of specific content. Only experts possess detailed knowledge in the field of interest since they are directly involved and each and every one of them has a particular opinion on the issue due to his or her individual position and observations.[10] Following, the expert interviews are analyzed using a structured content analysis in order to generate new insights concerning the two specific case study domains and beyond.

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[9] Yin, 2003 p. 12-13
[10] Cf. Gläser and Laudel, 2010 p. 11

6. Conclusion and Outlook

This study displayed the current developments in digital voting and digital identity solutions. While voting applications have not been of major interest in the conducted interviews due to regulations prohibiting the implementation of such solutions especially in Germany, digital identity solutions and standards are being worked on intensively. An approach of how to use blockchain technologies in a decentralized public key infrastructure has been presented. Governmental services could be linked to that identity, entitling citizens to access services digitally while efficient machine to machine communication and automated data processing between institutes and countries could also be enabled. Thus, the implementation of digital voting scenarios is also dependant on the creation of a secure and trusted digital identity solution. Furthermore, blockchains have been presented to function as an infrastructure connecting different institutes for data handling and provisioning.

In addition to the use cases, factors influencing the implementation of blockchains in the public domain were investigated. Moreover, challenges and opportunities associated with blockchains in the field have been discussed and technical as well as regulatory implications were presented.

Blockchains and the decentralization of public and governmental processes are such new paradigms that it takes time to develop application scenarios that are needed and wanted. The field is still in its infancy and experiences have to be made in order to keep up with the increasing speed of technological developments. Regulations should be eased in favor of innovative technologies like blockchains as happened during the Clinton era in the US to the development of the internet.[259] A constant knowledge exchange has to be established between all stakeholders if we want to understand state-of-the-art technologies and procedures while being able to make good policy choices. Blockchains and decentralized technologies offer great advantages over current centralized methods when applied right while offering the ability to change the way data and information are handled, leading to a more secure, transparent, trustworthy and interoperable digital environment not only governments but also citizens can benefit from.

We are early on in terms of blockchain utilizations in the public and governmental domain. Hence, more time needs to be invested in order to create solutions that comply with all regulations that are especially prevalent in this field. Decentralization, as mentioned before,

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[259] Cf. Reagle Jr., 1997

has to be understood by decision-makers before the public sector can be able to fully harvest the potential provided by blockchain technologies.

Research on how to apply public and permissionless blockchains in governmental affairs would contribute greatly to the field. Furthermore, current digital identity, as well as digital voting solutions, could be compared to national and international regulations as an extension of this work. Moreover, current authentication schemes and techniques should be evaluated in order to assure first block accuracy for these two use cases on a large scale. Additionally, it would be of great interest to assess the propensity to innovation in the public sector and governments nowadays so as to understand what adjustments have to be made in order to increase technology adoption.

Finally, blockchains might be a very secure combination of technologies. Nevertheless, interfaces to databases and technologies that do not possess this level of security might be harmful in an integrated ecosystem. Therefore, it is of utmost importance to understand what attack patterns might be feasible in general and how to guard against them. This would help to add areas worth protecting to the blockchain map while increasing trust because, in the end, cyber security of governmental services always has to be priority number one to guarantee national data security.