LOGOS, MYTHOS AND ETHOS OF BLOCKCHAIN: AN INTEGRATED FRAMEWORK FOR ANTI-CORRUPTION

ZIYA ALIYEV, DEPARTMENT OF PUBLIC ADMINISTRATION,
ERASMUS UNIVERSITY ROTTERDAM

IGBAL SAFAROV, SCHOOL OF GOVERNANCE,
UTRECHT UNIVERSITY

aliyev@essb.eur.nl
i.safarov@uu.nl

Key words: Blockchain, distributed ledger, corruption, anti-corruption, distribution, fair elections, trustless

Abstract

The research on corruption and anti-corruption mechanisms rarely emphasize the integration of technological and societal contexts of the problem. The development of innovative technologies provides state-of-the-art opportunities to deal with this deep-rooted challenge. In this paper, we question the reliability of blockchain technology as a tool for anti-corruption and look at how this tool can be utilized to reduce corruption in public administration. Theoretically, blockchain allows citizens to eliminate intermediaries in many public service delivery cases. In this regard, the implementation of blockchain into the public service delivery process may prevent some types of corruption activities. Using the two-round Delphi Method, 17 blockchain experts were requested to assess the potential of the blockchain, the benefits and barriers of blockchain technology in the anti-corruption process. Furthermore, the myths and ethical challenges of blockchain were presented to depict a more realistic framework of the technology in terms of fighting corruption.

This paper was submitted as part of a competitive call for papers on integrity and anti-corruption in the context of the 2019 OECD Global Anti-Corruption & Integrity Forum.

1. INTRODUCTION

The last 20 years delivered huge technological advancement that influenced the corruption situation around the world. On the one hand, together with the dissemination of new technologies and globalization, the corruption in public and private sectors changes its nature and appearance. Thus, public institutions dealing with corruption face emerging challenges to fight it. On the other hand, such reality becomes an impulse for public institutions to develop new methods, tools, and mechanisms to fight corruption. New technologies and innovations have long been adopted to increase the effectiveness of public services, bring transparency and fight corruption. However, there is not a simple innovation recipe, and public institutions need to examine the potential, possibilities, configurations, and complexities that sustainable innovation in the public sector requires (Osborne & Brown, 2011). Therefore, new technologies need to be well-studied before the implementation.

Blockchain technology is a distributed presentation of data (or ledger) which can record, store and allow access to the digital transaction without a central authority. A modified version of blockchain (called private blockchain) on the other hand, has a central authority(s) to regulate the permissions of users, access and distribution of the records. Each new record in blockchain is connected to the previous record by cryptographic methods, that is why blockchain records are unchallengeable. With removing the intermediaries, providing immutability and distributed consensus model, implementation of blockchain can disrupt traditional governance (Hughes, Park, Kietzmann, & Archer-Brown, 2019). Corruption and anti-corruption are particularly interesting cases to be discussed in the context of blockchain use. First, corruption is strongly associated with intimacy, hidden transactions, and distortion of the results. Blockchain, on the other hand, provides transparency and immutability. Second, corruption is associated with centralization and misuse of power. Blockchain brings new dimensions to the decentralization of power.

In this research, we address the research question of to what extent newly emerging blockchain can be implemented in the anti-corruption activities? Recently, many studies in academia and business started to investigate the implementation of blockchain in energy sector (Brilliantova & Thurner, 2018; Min, 2019), healthcare (Abujamra & Randall, 2019), supply chain (Wang, Singgih, Wang, & Rit, 2019), privacy (Feng, He, Zeadally, Khan, & Kumar, 2019), climate mitigation (Chen, 2018), democratic voting (Casado-Vara & Corchado, 2018) and other fields. This research is first attempt to reveal the potential of the blockchain, if any, for the anti-corruption use. The core argument of this study is that some characteristics of blockchain can be considered as a tool for anti-corruption mechanisms. To explore this argument and to separate the blockchain hype from possibilities, we use a Delphi method with the participation of 17 experts. First, we discuss blockchain and its possible use for anti-corruption to understand the technology and create the list of possible topics relevant to answer the research question. Then, we validate the potential of blockchain by asking the experts to evaluate the extracted topics in two rounds of Delphi study.

This research contributes to the literature by providing clarification of the possibilities of blockchain to be used in the anti-corruption activities. Based on the Delphi method, we extract the features of this

technology which are the most relevant characteristics for anti-corruption activities. Three core research findings of this study can be used to study this subject further and considered as a policy implication: (I Logos) several blockchain features can be considered as a strong facilitator for anti-corruption activities. Blockchain can clearly provide more transparency with disintermediation, immutable accountability, distribution of power and peer-to-peer solution; (II Mythos) blockchain cannot be considered as a solution to be used for all anti-corruption mechanisms; (III Ethos) before considering the implementation of blockchain in the public sector, several ethical questions and technical challenges need to be addressed.

The structure of this paper is organized as follow: we first provide a literature review covering the existing understanding of corruption and anti-corruption. Then we provide background information about the impact of new technologies on the level of corruption. In the final part of the conceptual framework, we briefly introduce the characteristics of the blockchain. In the second section, we discuss the Delphi method and the data collection procedure that we used. The results of the Delphi study are presented in the third section. Then, we provide discussion consisting of three parts: Logos - the reality behind the technology; mythos - non-deliverable promises; and ethos the credibility of blockchain and ethical questions in the context of anti-corruption. In the end, we provide the conclusion of the study.

2. CONCEPTUAL FRAMEWORK

2.1 What have we learned about corruption and anti-corruption?

Corruption is an abuse of entrusted power for private gain (TI, 2009, p. 14). It manifests in a variety of forms such as bribery, embezzlement, rent-seeking, nepotism. Corruption occurs both in the public and private sectors and ranges from petty to grand in scope, from political to bureaucratic in focus, from incidental to systematic in frequency, and from individual to systemic in nature. In this paper, we address corruption in the public sector and at the country level.

Anti-corruption is a set of activities supposed to eradicate and prevent corruption. Anti-corruption is intrinsically linked to corruption, but it is substantially different. In terms of a medical analogy, if corruption is a disease, then anti-corruption like antibiotic (Klitgaard, 2000, p. 4). Although bacteria and antibiotics are related to each other, they are substantially different in their structure.

There is no standardized anti-corruption approach. Context is crucial for the success of anti-corruption in a given country. Nevertheless, there can be distinguished three basic anti-corruption approaches: *interventionist*, *managerial* and *holistic* (McCusker, 2006, p. 8). *Interventionist approach* implies a post-factum intervention and punishment of the offender. As a punitive measure, it relies on intimidation and deterrence. Although it contributes to the deterrence, its effectiveness is highly doubted (Disch, Vigeland, Sundet, & Gibson, 2009, p. 11). *The managerial approach* aims to discourage officials from engaging in the corrupt act by eliminating opportunities and creating an equilibrium where the cost of engaging in a corrupt act is higher than its benefits.

However, both *interventionist and managerial approaches* fail in case of systemic or organizational corruption. In contrast to individual corruption, systemic corruption refers to corrupt organizations rather than to corrupt individuals within an organization. In the case of systemic corruption, private interest de-facto manifests as a goal of public organization and corruption appear as a collective rule-breaking action that helps achieve this particularistic goal. Interventionist and managerial approaches fail in case of systemic corruption because those who are supposed to punish the corrupt officials themselves are part of the systemic corruption (Persson, Rothstein, & Teorell, 2010). In a systemic corruption situation, the principal does not prevent corrupt behavior; on the contrary, he creates incentives for corrupt activity and in some cases even organizes it. Furthermore, over time systemic corruption institutionalizes and becomes embedded in the organizational culture (Aliyev, 2018, p. 12).

Thus, successful anti-corruption in a given country requires a multi-layered and holistic approach. One of such approaches is the National Integrity System (NIS) introduced by the TI (Pope, 2000, p. 34). It aims to combat corruption via good governance and by promoting integrity. The NIS is based on the evaluation of institutional pillars such as legislature, executive, judiciary, public sector, law enforcement agency, electoral management body, ombudsman, supreme audit institution, anti-corruption agency, political parties, media, civil society, business (TI, 2012, p. 3). Each institutional pillar is enhanced by the core rules and practices namely conflict of interest rules, fair elections, power to question senior officials, public recording, public service ethics, independence, access to information, freedom of speech, records management, enforceable and enforced laws, competition policy including public procurement rules and effective mutual international legal/judicial assistance (Pope, 2000, p. 37). The holistic approach of the NIS implies that instead of one separate institution, the system focuses on inter-relationships, inter-dependence and combined effectiveness of institutional pillars enhanced by core rules and practices. Pope (2000, p. 37) notes that there is little use of honest judges if the police are corrupt. Cases of corruption will not reach the courts.

2.2 Anti-corruption and information technologies

Innovation and technologies have long been studied as a tool to fight or at least, to limit corruption. Along with the traditional factors such as development level of professionalism, institutionalization, and quality of bureaucracy and law enforcement (Shim & Eom, 2008), a broad range of literature in social science investigate the role of information and communication technologies in the anti-corruption process. By using the e-government survey data from the United Nations, Elbahnasawy (2014) confirms the robust role of e-government implementation in fighting corruption. The research indicates that the telecommunication infrastructure along with the quality of online services has a statistically strong and positive impact on anti-corruption activities. Furthermore, using semantic technologies enable to recognize and prevent irregularities earlier in public activities, particularly in public procurement which is one of the most corruption-sensitive areas by developing rules and alerts for specific conditions (Miroslav, Miloš, Velimir, Božo, & Đorđe, 2014).

Shim and Eom (2008), on the other hand, differentiate e-government and e-participation in the anti-corruption process. According to the study, e-government decreases the level of corruption by improving the efficiency of internal and managerial control over the activities of government

organizations. E-participation reduces corruption by enhancing transparency and accountability in the public sector. E-government implementation diminishes corruption in a country particularly by increasing the access to information, transparency, and accountability (Elbahnasawy, 2014).

However, Nam (2018) claims that the impact of e-government on decreasing corruption is significantly determined by economic, political, and cultural characteristics. In a country where high power distance and uncertainty avoidance exist the impact of e-government maturity on corruption will be significantly lower. Following this idea, Göbel (2013) highlights that information technology can be an opportunity for countries to improve surveillance capacity and total control over society. In general, there is a mixed relationship among technology implementation, e-government performance and anti-corruption.

2.3 Characteristics of blockchain technology

Recently, the potential of newly emerged blockchain technology has been extensively discussed in the academic literature for understanding its wide range of implementation possibilities in business, governance and delivering public services. While there is not a universally accepted definition of the blockchain, the more detailed definition of it is provided by Drescher (2017, p. 35):

> *The blockchain is a purely distributed peer-to-peer system of ledgers that utilizes a software unit that consists of an algorithm, which negotiates the informational content of ordered and connected blocks of data together with cryptographic and security technologies in order to achieve and maintain its integrity.*

With its fundamentally different features namely, distributed ledgers, transparency and trackability, non-reversibility/Immutability and smart contracts, the primary blockchain implementation fields are money transfer and financial services, property registries, contracts and agreements, and identity confirmation (Swan, 2017). Current database and information systems are typically located in one or two locations (along with backup database). Such information systems are highly centralized which always keep the possibility of a single point of failure. Furthermore, conventional systems are sensitive to cyber attacks.

As the report by the UK Government Chief Scientific (UKGCSA, 2016) describes, distributed ledger technologies are resistant to unauthorized change and cyber attacks because attacks or unauthorized changes would have to target all the distributed nodes and ledgers of the network simultaneously to be successful. Some blockchain technologies, such as Hyperledger[1] which is developed by Linux Foundation, does rely on trusted parties; therefore it is named as permissioned blockchain service. Trustless blockchain technologies, on the other hand, allow the users to see and trace publicly shared ledgers without a central administration. Furthermore, the recorded blocks or information on the ledger cannot be replaced, removed and changed (or it is very hard to do so).

[1] https://www.hyperledger.org

Smart contracts of blockchain technology are self-executing algorithms that are stored in the blockchain (Christidis & Devetsikiotis, 2016). Smart contracts allow the users to have computations and execution of automated procedures which take place on the distributed network. Such automated contracts have a significant potential to increase the efficiency of commercial operations, decrease transaction and legal costs, and facilitate transparency or anonymity of information flow depending on the fundamental features of the implemented blockchain technology (Giancaspro, 2017). Nevertheless, there are challenges of smart contracts and their implementation in terms of the legal enforceability of smart contracts and the place of them in the existing legal framework.

3. METHODS

As already mentioned, the Delphi method is used in this research. This study method has been employed in a wide range of studies. Linstone, Turoff, and Helmer (2002) define the Delphi method as a tool for constructing a structured group communication to allow expert groups to solve a complex problem. To solve the problem as a result of structured communication, individual feedbacks of the panel experts are provided in the first stage and group judgment and assessments are provided in the next stage. Delphi method allows the experts to modify provided feedback as a consequence of the group judgment.

Taking into consideration that blockchain technology and its potential use cases/impact on the anti-corruption process has not been studied yet, using the Delphi method to clarify the research question is a feasible choice. Furthermore, the majority of the blockchain studies have been targeted to explain its broader and most hyped features from the perspective of business usage. As we focus on one of the most prominent societal problems - anti-corruption and newly emerging technological innovation, using the expert panel which represents more in-depth knowledge and information from the field of blockchain can be considered an effective way to answer the research question.

Expert selection

Compared with other survey methods, expert panel participants in the Delphi method are not randomly selected (Hasson, Keeney, & McKenna, 2000). Rowe and Wright (1999) emphasis four primary features of the Delphi method: the anonymity of expert panel participants, iteration, controlled feedback and statistical generalization of results. Expert selection determines the quality of the results. In this study, two groups of experts were considered: blockchain experts from the blockchain service provider companies and foundations, experts with the expertise to develop blockchain solutions and services. This expert panel helps us to reach a broader knowledge base and expert opinions covering both blockchain service providers and service users. In the first stage of expert selection, 31 experts were invited to take part in the research. The experts were found from LinkedIn profiles, academic and non-academic publications, and snowballing method. 10 blockchain service providers were invited to participate in the research and 5 of them agreed to participate in the research project. 12 out of 21 experts who have expertise in the implementation of blockchain technology in various fields accepted our invitation. Delphi study stages are presented in Figure 1.

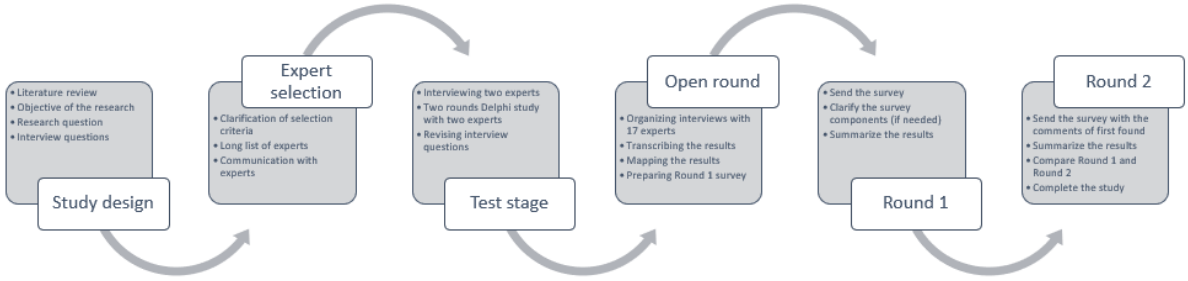

Figure 1. Delphi study stages

We started the Delphi method with open-ended interviews to cover the most critical issues regarding the implementation of blockchain technology in the anti-corruption process. We then analyzed interview results to determine major subjects discussed by the experts and categorized them into 3 topics and 20 subjects. Experts had an opportunity to add more comments and clarification for each selected item. 17 experts were involved in the open round, and 15 experts completed the following rounds of Delphi study.

After the literature review and research design, we communicated the experts and received confirmation for their participation. Then, we tested the study design with two experts by mimicking open round, and then the first and second round of Delphi method, one with anti-corruption and anti-fraud expert and other with innovation implementation expert. Considering the test results, we adjusted the interview structure and following the survey process. Together with open round, Delphi study started 1 June 2018 and ended 1 October 2018. The surveys were created with Google Form and sent to the experts via email. Each time, we introduced the research goal, researchers and the structure of the research to the participants. The survey form was designed in a way that the participants could comment on their opinions on each question. To evaluate each question was mandatory; however, the participants could quit providing further comments. Each item had to be evaluated in the scale of 0 to 10.

4. DELPHI STUDY RESULTS

Open round

The open round started by asking two broad questions: Can blockchain technology be used to reduce corruption? And in which way blockchain technology can contribute to the anti-corruption process? We first discussed the most relevant features of the blockchain. Four functionality features and two types of blockchain were selected for the first Delphi evaluation round. Next, we debated the nature of corruption and anti-corruption mechanisms. To do so, we introduced the mechanisms that can be used to fight corruption. The experts were asked to provide possible use cases and justification to understand blockchain's potential in the anti-corruption process.

All the provided answers were summarized and categorized under three topics: the most relevant blockchain features; blockchain technology in anti-corruption use and challenges of blockchain to be used in anti-corruption activities. Only the subjects of the second topic were extracted from the

academic literature, which also found support by the experts with varying degree of confidence. Finally, we selected five challenges that may have an impact on blockchain implementation in anti-corruption activities. While experts presented some context-specific and very technical challenges, we picked the most frequently discussed subject to be evaluated in the Delphi study.

Topic	Subject	Description
1. The most relevant blockchain features	1.Transparency/traceability	Every transaction in a blockchain is recorded in a traceable and cryptographically encrypted way.
	2. Smart contracts	Smart contracts automatically validate (or reject) an algorithmic condition (e.g., contract terms) without trusted third parties.
	3. Non-reversibility	Recorded transactions cannot be changed, deleted and edited.
	4. Decentralization	A powerful central authority does not exist. A consensus protocol validates each transaction.
	5. Public blockchain	Without confirmation or permission, anyone can participate in the blockchain consensus process.
	6. Private (permissioned) blockchain	A central organization (or few organizations) controls blockchain records and permission.
2. Blockchain technology in anti-corruption use	7. Conflict of interest	A situation where a public official is confronted with choosing between the public and private duties.
	8. Merit-based recruitment	A process where a public official is recruited and promoted because of his work quality.
	9. Free and fair elections	The freedom of voters such as having the right to vote, freedom of choice, while fairness refers to conditions under which political parties compete.
	10. Financial reporting and accountability	Efficient and effective financial management practices combined with appropriate accounting systems and reviews by auditors (Pope, 2000: p. 221).
	11. Judiciary independence	The independence of the judiciary branch from the other branches of government and private interest.
	12. Access to information	Citizen's right of access to information/records and the government's obligation to facilitate this access.
	13. Freedom of speech	"Freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers." (UN General Assembly, 1948)
	14. Records management	A process of collection, storage, sharing and use of data and information by the government.
	15. Competition policy including public procurement rules	Involves transparency and impartiality of the state in competition policy and in the public procurement process.
3. Challenges of blockchain to be used in anti-corruption activities	16. Privacy issues	Blockchain may allow non-authorized parties to reveal personal information without the intention of the data owner.
	17. The maturity of blockchain technology	Blockchain technology is newly emerging. It is not ready to be implemented in the public sector considering security issues and scalability.
	18. Cross-border nature	Decentralized blockchain can cover multiple regions and countries.
	19. Financial resources	The blockchain is a new technology which may require a significant amount of financial (also human) resources to be implemented.
	20. Use for corruption	Some blockchain services may be used to hide the corrupt activities (e.g., payments with privacy currencies).

Table 1. The topics, subjects and definitions.

First round: Evaluating the subjects

Taking into consideration the results of open round brainstorming, 20 subjects were evaluated in the first round of Delphi study. One out of six blockchain features did not find support in this round. Nine anti-corruption subjects were discussed which none of them found support in the first round. Nevertheless, fair election, access to information and records management received more than 6 scores. Surprisingly, the majority of the experts did not give a higher score to the proposed challenges of blockchain implementation in the anti-corruption activities. Only the cross-border nature of blockchain received 6 scores with a relatively higher standard deviation (2.89). Overall, while the blockchain features found support to be implemented for anti-corruption, anti-corruption mechanisms have not been found support in this round.

Second round: Contrasting Explanations

With the results of the first round and justification of experts, we asked 15 experts to evaluate the proposed subjects again. According to the results, the potential of private (permissioned) blockchain to be used in anti-corruption activities was rejected by the experts. The rest of the blockchain features found similar support comparing to the first round and consensus has been achieved. In the second round, three out of nine anti-corruption mechanisms, namely fair elections, financial reporting and accountability, and records management found significant support and achieved consensus with 80% or more score. The scores of three out of five challenges were increased in the second round. Except for the cross-border nature characteristics, none of the challenges found strong support. The experts considered that the cross-border nature of blockchain makes it difficult to regulate.

Table 2. Summary of Round 1 and Round 2 results

Subject	Round 1			Round 2		
	Average score	Standard deviation	Consensus with score 8,9,10 (%)	Average score	Standard deviation	Consensus with score 8,9,10 (%)
1. Transparency/traceability	9,1	1,22	93,3	9	1,20	93,3
2. Smart contracts	9,2	1,15	93,3	9,5	0,92	93,3
3. Non-reversibility	9,2	1,37	93,3	9,4	0,92	93,3
4. Decentralisation	8,5	1,41	73,3	8,9	1,30	86,7
5. Public blockchain	7,7	2,55	73,3	7,9	2,42	73,3
6. Private (permissioned) blockchain	3,1	2,33	0	2,8	2,08	0
7. Conflict of interest	1,8	0,94	0	2	1,07	0
8. Merit-based recruitment (e.g. with reducing jobs in the civil service)	3,1	1,46	0	2,9	1,22	0
9. Fair elections	6,7	2,16	33,3	8,7	1,28	80,0
10. Financial reporting and accountability (officials, political parties, lobbies etc.)	6,3	1,62	20,0	8,8	1,37	86,7
11. Judiciary independence	2,7	1,98	6,7	1,9	0,96	0
12. Access to information	7,4	1,45	40,0	7,7	1,76	66,7
13. Freedom of speech	4,7	1,40	0	4,9	2,00	13,3
14. Records management (ability to change data later)	6,9	1,81	20,0	8,5	1,19	86,7

15. Competition policy including public procurement rules	4,9	1,85	13,3	5,2	2,14	20,0
16. Privacy issues	3,8	2,54	13,3	3,1	2,29	6,7
17. Maturity of blockchain technology	5,4	2,06	20,0	7,1	2,74	60,0
18. Cross-border nature	6	2,89	40,0	8,2	1,26	80,0
19. Financial resources	4,1	2,91	13,3	3,4	2,72	6,7
20. Use for corruption	5,4	2,23	13,3	6.3	2,74	40,0

5. DISCUSSION

5.1 Logos: the reality behind the blockchain

A broad range of potential use cases, ambitions presented by the blockchain service providers and multifunctionality of blockchain make it challenging to evaluate the potential of this technology. The Delphi study results demonstrate that the functionalities of blockchain technology can be implemented as a tool to fight corruption. Transparency and trackability functions of blockchain have been highly appreciated by the experts who provide significant control mechanisms over various operations and transactions [expert comment, 2, 3, 6, 8].

Decentralization brings two main strengths to blockchain technology: security and removing a single point of failure [expert comment, 4]. By testing a crowdsource corruption reporting platform (e.g., *I paid a bribe*), a recent study highlights that anonymity of posts and possibility to verify poster's credentials (with reliable anonymization techniques) are critical to being successful (Ryvkin, Serra, & Tremewan, 2017). Such technical features can easily be handled by the privacy layer and irreversibility features of blockchain [expert comment, 2]. Furthermore, the decentralized nature of blockchain can allow corruption reporting platforms to be manipulation resistant.

Delphi study results show that only three out of nine anti-corruption mechanisms found a strong consensus: fair elections; financial reporting and accountability; records management. In the first round of Delphi study, fair elections received 33.3%, records management received 20%, and financial reporting and accountability received 20% of consensus (with score 8, 9, 10) with 6.3 average scores. After receiving the supportive arguments and cases from the experts, we summarized the feedback, and it became the input for the second round. The justifications provided by the experts in the first round significantly increased the consensus level in the second round.

One of the most frequently mentioned use cases of blockchain is its use for online voting. Unlike conventional technologies, blockchain allows to bring end-to-end transparency to the voting process and results with strictly protecting the anonymity of the voters [expert comment, 11]. The conventional electronic voting systems are highly fragile, expensive and always open for hacker attacks. Blockchain voting tools decrease the security challenges and make voting cheaper [expert comment, 3]. While there are several blockchain-based voting services, there are several technical and governance-related problems that need to be solved. As an expert highlights,

> Anonymity and privacy of the voters are the main challenges of existing blockchain solutions that provide voting services. That is why, it is hard to implement such tools in a national, and politically sensitive elections [expert comment, 15].

Nearly all the features of blockchain discussed as a facilitator of financial reporting and accountability. Particularly, transparency and non-reversibility feature of public blockchain allow achieving transactional transparency and accountability in financial operations. By removing intermediaries, blockchain reduces the possibilities to third-party interventions to the accountability systems. As an expert argues,

> Citizens do not have access to transactions in financial activities. If the intermediaries corrupted, we will not be able to see the benefits of so-called accountability. But, implementation of blockchain will allow seeing day-by-day transactions [expert comment, 7].

Together with financial reporting and accountability, records management received the highest consensus (86.7%) in the blockchain technology in anti-corruption use topic. The experts supported the idea that blockchain technology can successfully be implemented in records management to achieve information integrity. However, before mass implementation, the regulation, scalability, reliability of existing services and possible security issues need to be solved [expert comment, 2, 3, 13]. The existing solutions, such as *recordskeeper.co* allow verifying data without trusted third parties. Furthermore, in blockchain based records management systems, there is not a central authority, and the storage of information is organized in a peer-to-peer technique which reduces the possibility of unauthorized modification of information [expert comment, 6].

5.2 Mythos: non-deliverable promises

According to expert opinions, blockchain technology cannot be considered as a solution in many anti-corruption mechanisms. While there are some possibilities, this technology will not prevent conflict of interest, merit-based recruitment, judiciary independence, freedom of speech and competition policies. Consequently, it is a myth to presume that blockchain can be used as a solution for all anti-corruption mechanisms. The myths of blockchain are either related to the technical features of it or the nature of a service that is considered to be transformed with blockchain. As an expert highlights,

> First of all, before implementing blockchain, several technical questions need to be answered. The existing blockchain solutions do not have high performance (millions of transactions) capacity. If there is a huge demand for data storage, it is impossible to use blockchain

In many public and private services, there are only one or very few organizations that update data. For example, in the judiciary system, there is a very limited number of institutions that publish final decisions publicly. Such cases reduce the possibility of the implementation of blockchain [expert comment, 9]. Because successful blockchain implementation requires many (desirably hundreds) parties to have authority to read and write to the distributed ledger.

While blockchain can be thought a supportive instrument for preventing conflict of interest and freedom of speech, it is very hard, if possible, to implement it in these anti-corruption mechanisms. Blockchain should not be considered as a mechanism to replace the existing systems (including database, e-government services) - it should supplement the systems [expert comment, 3].

5.3 Ethos: the credibility of blockchain in the context of anti-corruption

A possible implementation of blockchain in the public sector brings new challenges which necessitate more attention. While privacy issues did not find support in the Delphi study, the emerging blockchain literature raises a question about privacy issues. It is not surprising that a recent systematic literature review revealed that security, privacy, and scalability of blockchain are the most frequently studied challenges in blockchain literature (Macrinici, Cartofeanu, & Gao, 2018). Several experts consider that blockchain technology has not been matured yet [expert comment, 2,3, 6, 15]. That is why it is hard to implement it in sensitive public services. As an expert highlights,

> We have some idea about how it can be used in, let us say voting. But we are not sure whether it is safe, secure or not. Blockchain has a significant level of scalability issues. There are many promises in this regard, but these promises have not been delivered yet [expert comment, 6]… We need to be careful to implement blockchain when we are not 100% sure about the GDPR compliance of new systems [expert comment, 13].

Delphi study results rejected the possibility of efficient usage of private blockchain as a tool in the anti-corruption process. On the other hand, public blockchain gained more support to be implemented in anti-corruption activities. Along with the advantages of distributed and permissionless features of the blockchain, it brings new ethical concerns as well. The public blockchain is predominantly community-driven. That is why it decreases the responsibility of individual users and increases the impact of coordination [expert comment, 8].

The experts highlighted the cross-border nature and maturity level of blockchain more than any other challenge. The cross-border nature increases the difficulty of regulation [expert comment, 1, 2, 6, 13]. Regulation of blockchain, particularly manipulative cryptocurrency markets is very important. Because, such markets can be used for money laundering and illegal money transfers [expert comment, 4]. Several blockchain solutions remove records, which is called privacy cryptocurrencies (e.g., Monero). While the experts did not wholly support (40% consensus in the second round) the possibilities of blockchain to be used as a tool for corruption, such privacy currencies have potential to be used in the illegal transactions [expert comment, 4, 6]. However, as the privacy currencies should be exchanged to fiat currency, it should not be considered as a significant challenge [expert comment, 10].

6. CONCLUSION

The main aim of this study was to explain the uncertainty of hyped blockchain and its potential use in anti-corruption activities. We conducted the first Delphi study cover the research gap in this field. Starting with an open-ended interview with 17 blockchain experts, we listed 20 subjects regarding the potential of blockchain, anti-corruption use and challenges and evaluated the initially proposed subjects in the two-round Delphi survey. This study contributes both blockchain and anti-corruption literature as it is the first attempt to combine both. It is possible to present three primary findings of this study as follow.

First, Delphi study results demonstrate that several blockchain features can be considered as a strong facilitator for the anti-corruption activities. Blockchain can clearly provide more transparency with disintermediation, immutable accountability, distribution of power and peer-to-peer solution. As transparency and accountability are considered one of the most impactful mechanisms to fight corruption (Bauhr & Grimes, 2014; Sohail & Cavill, 2008), blockchain can facilitate public services with transactional transparency and accountability. Blockchain can bring a new dimension to the transparency and trust in the public administration and public institutions.

Second, blockchain cannot be considered as a solution to be used for all anti-corruption mechanisms. This result well-aligns with the research results of Lo, Xu, Chiam, and Lu (2017) who present that blockchain is not a universally applicable instrument. The authors propose an evaluation outline for blockchain implementation in specific fields such as the supply chain, the stock market, and identity management. After the second round of Delphi study, only 3 out of 9 anti-corruption subjects were found significant consensus (fair elections, financial reporting and records management). It implies that even if we can think about the implementation of blockchain as a supplementary tool, it cannot be considered as a “silver bullet” to fight corruption.

Third, before considering the implementation of blockchain in the public sector, several ethical questions need to be answered. First of all, in the present shape, the majority of the blockchain services are self-organized communities that function without or little regulation. Cross-border nature of blockchain makes it difficult to regulate. As Guo and Liang (2016) note with its cross-border nature, blockchain brings new possibilities to the financial sector which could transform the payment technologies and credit information systems in financial institutes. However, along with the self-governing nature of blockchain, cross-border mechanisms also require systematic regulation (e.g., compliance with the GDPR) which is unsolved yet.

Along with the research results, we present the future research agenda. This research results can be used as a starting point to explore real-life use cases of blockchain for anti-corruption activities. The results confirm the necessity of a continuous study in this field. Future research can investigate the implementation of blockchain in each anti-corruption mechanism separately together with scenario development. Our objective in this research was to depict an integrative picture of possible blockchain implementation. That is why we did not focus technical details and features of the blockchain. Future studies can also explore the technical features of blockchain and its potential in the anti-corruption

process. To do so, it would be beneficial to develop an evaluation framework (or checklist) for blockchain's implementation in an anti-corruption activity. Similar frameworks were developed for evaluating the applicability of blockchain in various industries, not anti-corruption activities (Lo, Xu, Chiam, & Lu, 2017; Wüst & Gervais, 2017). Furthermore, the challenges and barriers of existing blockchain solutions can be handled and studied as separate research.

REFERENCES

Abujamra, R., & Randall, D. B. T.-A. in C. (2019). Blockchain applications in healthcare and the opportunities and the advancements due to the new information technology framework. Elsevier. https://doi.org/https://doi.org/10.1016/bs.adcom.2018.12.002

Aliyev, Z. (2018). Institutionalization of corruption in post-Soviet public organizations.

Bauhr, M., & Grimes, M. (2014). Indignation or Resignation: The Implications of Transparency for Societal Accountability. *Governance*, *27*(2), 291–320. https://doi.org/10.1111/gove.12033

Brilliantova, V., & Thurner, T. W. (2018). Blockchain and the future of energy. *Technology in Society*. https://doi.org/https://doi.org/10.1016/j.techsoc.2018.11.001

Casado-Vara, R., & Corchado, J. M. (2018). Blockchain for democratic voting: how blockchain could cast off voter fraud. *Oriental Journal of Computer Science and Technology*, *11*(1). https://doi.org/http://dx.doi.org/10.13005/ojcst11.01.01

Chen, D. (2018). Utility of the Blockchain for Climate Mitigation. *The Journal of The British Blockchain Association*, *1*(1), 1–9. Retrieved from https://jbba.scholasticahq.com/article/3577.pdf

Christidis, K., & Devetsikiotis, M. (2016). Blockchains and Smart Contracts for the Internet of Things. *IEEE Access*, *4*, 2292–2303. https://doi.org/10.1109/ACCESS.2016.2566339

Disch, A., Vigeland, E., Sundet, G., & Gibson, S. (2009). Anti-Corruption Approaches A Literature Review, *1*. Retrieved from https://www.sida.se/contentassets/3f5c8afd51a6414d9f6c8f8425fb935b/anti-corruption-approaches-a-literature-review_3153.pdf

Drescher, D. (2017). *Blockchain Basics: A Non-Technical Introduction in 25 Steps*. Frankfurt. https://doi.org/10.1007/978-1-4842-2604-9

Elbahnasawy, N. G. (2014). E-Government, Internet Adoption, and Corruption: An Empirical Investigation. *World Development*, *57*, 114–126. https://doi.org/https://doi.org/10.1016/j.worlddev.2013.12.005

Feng, Q., He, D., Zeadally, S., Khan, M. K., & Kumar, N. (2019). A survey on privacy protection in blockchain system. *Journal of Network and Computer Applications*, *126*, 45–58. https://doi.org/https://doi.org/10.1016/j.jnca.2018.10.020

Giancaspro, M. (2017). Is a 'smart contract' really a smart idea? Insights from a legal perspective. *Computer Law & Security Review*, *33*(6), 825–835. https://doi.org/https://doi.org/10.1016/j.clsr.2017.05.007

Göbel, C. (2013). The Information Dilemma: How ICT Strengthen or Weaken Authoritarian Rule. *Statsvetenskaplig Tidskrift*. https://doi.org/http://journals.lub.lu.se/index.php/st/article/view/9744

Guo, Y., & Liang, C. (2016). Blockchain application and outlook in the banking industry. *Financial Innovation*, *2*(1), 24. https://doi.org/10.1186/s40854-016-0034-9

Hasson, F., Keeney, S., & McKenna, H. (2000). Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing*, *32*(4), 1008–1015. https://doi.org/10.1046/j.1365-2648.2000.t01-1-01567.x

Hughes, A., Park, A., Kietzmann, J., & Archer-Brown, C. (2019). Beyond Bitcoin: What blockchain and distributed ledger technologies mean for firms. *Business Horizons*. https://doi.org/https://doi.org/10.1016/j.bushor.2019.01.002

Klitgaard, R. (1988). *Controlling corruption*. (U. of C. P. (Berkeley), Ed.).

Linstone, H., Turoff, M., & Helmer, O. (2002). *The Delphi Method Techniques and Applications*. Addison-

Wesley Educational Publishers Inc.

Lo, S. K., Xu, X., Chiam, Y. K., & Lu, Q. (2017). Evaluating Suitability of Applying Blockchain. In *2017 22nd International Conference on Engineering of Complex Computer Systems (ICECCS)* (pp. 158–161). https://doi.org/10.1109/ICECCS.2017.26

Macrinici, D., Cartofeanu, C., & Gao, S. (2018). Smart contract applications within blockchain technology: A systematic mapping study. *Telematics and Informatics*, *35*(8), 2337–2354. https://doi.org/https://doi.org/10.1016/j.tele.2018.10.004

McCusker, R. (2006). *Review of anti-corruption strategies*. Australian Institute of Criminology Canberra.

Min, H. (2019). Blockchain technology for enhancing supply chain resilience. *Business Horizons*, *62*(1), 35–45. https://doi.org/https://doi.org/10.1016/j.bushor.2018.08.012

Miroslav, M., Miloš, M., Velimir, Š., Božo, D., & Đorđe, L. (2014). Semantic technologies on the mission: Preventing corruption in public procurement. *Computers in Industry*, *65*(5), 878–890. https://doi.org/https://doi.org/10.1016/j.compind.2014.02.003

Nam, T. (2018). Examining the anti-corruption effect of e-government and the moderating effect of national culture: A cross-country study. *Government Information Quarterly*, *35*(2), 273–282. https://doi.org/https://doi.org/10.1016/j.giq.2018.01.005

Osborne, S., & Brown, L. (2011). Innovation, public policy and public services delivery in the UK. The word that would be king? *Public Administration*, *89*(4), 1335–1350. https://doi.org/10.1111/j.1467-9299.2011.01932.x

Persson, A., Rothstein, B., & Teorell, J. (2010). The failure of anti-corruption policies a theoretical mischaracterization of the problem. *QoG Working Paper Series*, *19*(10), 1–2.

Pope, J. (2000). Confronting corruption: The elements of a national integrity system. *Transparency International*.

Rowe, G., & Wright, G. (1999). The Delphi technique as a forecasting tool: issues and analysis. *International Journal of Forecasting*, *15*(4), 353–375. https://doi.org/https://doi.org/10.1016/S0169-2070(99)00018-7

Ryvkin, D., Serra, D., & Tremewan, J. (2017). I paid a bribe: An experiment on information sharing and extortionary corruption. *European Economic Review*, *94*, 1–22. https://doi.org/https://doi.org/10.1016/j.euroecorev.2017.02.003

Shim, D. C., & Eom, T. H. (2008). E-Government and Anti-Corruption: Empirical Analysis of International Data. *International Journal of Public Administration*, *31*(3), 298–316. https://doi.org/10.1080/01900690701590553

Sohail, K., & Cavill, S. (2008). Accountability to Prevent Corruption in Construction Projects. *Journal of Construction Engineering and Management*, *134*(9), 729–738. https://doi.org/10.1061/(ASCE)0733-9364(2008)134:9(729)

Swan, M. (2017). Anticipating the Economic Benefits of Blockchain. *Technology Innovation Management Review*, *7*(10). Retrieved from https://timreview.ca/sites/default/files/Issue_PDF/TIMReview_October2017.pdf#page=6

TI. (2012). National Integrity System Assesment Toolkit. *Transparency International Secretariat Policy and Research Department*. Retrieved from https://www.transparency.org/files/content/nis/NIS_AssessmentToolkit_EN.pdf

UKGCSA. (2016). Distributed Ledger Technology: beyond block chain. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf

Wang, Y., Singgih, M., Wang, J., & Rit, M. (2019). Making sense of blockchain technology: (How) will it transform supply chains? *International Journal of Production Economics*. https://doi.org/https://doi.org/10.1016/j.ijpe.2019.02.002

Wüst, K., & Gervais, A. (2017). Do you Need a Blockchain? *2018 Crypto Valley Conference on Blockchain Technology (CVCBT)*, 45–54.