IF THE MOUNTAIN WON'T COME TO MUHAMMAD, THEN MUHAMMAD MUST GO TO THE MOUNTAIN: PUBLIC ADMINISTRATION IN THE AGE OF GLOBALIZATION AND EMERGING TECHNOLOGIES[1]

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If we imagine the proverb "*if* the *mountain* won't *come* to *Muhammad*, then *Muhammad* must *go to the mountain"* as an equation with two variables, information and communication (ICT) technologies and public administration, it will not matter which place each one of them will take in the equation. In the present times of digital disruption, fourth industrial revolution - or any other expression we would like to take to describe our times – they are compelled to meet at some point, even if they prefer to avoid the encounter. The public administration will have to adapt to the pulse of the time, if it likes it or not. However, the emerging technologies need to be applied to the reality of a man-made world and facilitate interactions and business of citizens – living human beings, thought processes of which are (so far still) to a great extent different from the machine learning, algorithms or any other technological processes.

The following contribution would like to shed light on the interplay between public administration, blockchain technology and citizens. This interplay will be examined from a broader perspective, setting the developments in the field of emerging technologies in the context of sustainable development. Consequently, closer focus will be paid to the application of blockchain technology in the field of public administration and its potential to enhance trust from the citizens' perspective and in this way transform the relationship between public administration and citizens. The article follows a recommendation given by

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[1] The research leading to this result has received funding from People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme (FP7/2007-2013) under REA grant agreement n° 317767 – Acronym of the Project: LIBEAC (2013–2016) entitled "Liberalism in Between Europe And China" within the results of gLAWcal - Global Law Initiatives for Sustainable Development (United Kingdom) coordinated by Professor Paolo Davide Farah

previous scholars doing a research on the blockchain technology from various angles, who identified the lack of research on the potential of blockchain "to address societal needs."[2] Considering that the field of ICT technologies is inherently international, and their pervasiveness can be seen as a symptom of borderless globalization,[3] excessive liberalism and lack of global governance,[4] the paper will make use of relevant examples from a variety of countries irrespective of their regional location.

I. SETTING THE SCENE

At the times of technological disruption, the resilience of governments against threats and perhaps even their legitimacy in the eyes of their citizens demanding higher transparency and accountability will to a great extent depend on the quality of their e-government services.[5] Emerging technologies, such as

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[2] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 355 (2017).

[3] The Authors recognize the differing approaches to internet, for example the differences between free internet and internet sovereignty, which is a concept promoted and practiced in China and which is increasingly being spread also to countries with close ties to China or with sympathies towards China's approach to internet, such as Russia, Iran or members of China-dominated groupings such as the Shanghai Cooperation Organization. In 2011, China together with Kazakhstan, Kyrgizstan, Russia, Tajikistan and Uzbekistan submitted to the United Nations the document titled "International Code of Conduct for Information Security", which promoted the concept of internet sovereignty. The concept of internet sovereignty has risen to prominence after it was mentioned by the Chinese President Xi Jinping on World Internet Conference in Wuzhen in 2015. In his speech, he derived the concept of internet sovereignty from the principle of sovereign equality enshrined in the Charter of the United Nations and argued for the sovereign right of countries to regulate cyberspace in their own way. China's approach to internet is an approach of an authoritarian country applying censorship and surveillance. Good example for this is the so-called "Great Firewall of China". It is reasonable to consider this information also when thinking about the application of emerging technologies, such as blockchain, in the context of government. For more on China's approach to internet and internet sovereignty, see Jinghan Zeng & Tim Stevens & Yaru Chen, *China's Solution to Global Cyber Governance: Unpacking the Domestic Discourse of "Internet Sovereignty", in* 45 (3) POLITICS AND POLICY 432, 432-464 (2017).

China's unique approach to internet should be seen also in the light of other developments in the country, such as the introduction and implementation of the Social Credit System, purpose of which is essentially to utilize data surveillance for the sake of State-run surveillance of governmental and judicial affairs as well as social and commercial activities and interactions, coupled with the introduction of a reward and punishment mechanism. For more on the Social Credit System in China, see Fan Liang et al., *Constructing a Data-Driven Society: China's Social Credit System as a State Surveillance Infrastructure, in* 10 (4) POLICY & INTERNET 415, 415-453 (2018).

[4] Paolo Davide Farah, *Foreword*, in Margaret Stout and Jeannine Love, INTEGRATIVE GOVERNANCE: GENERATING SUSTAINABLE RESPONSES TO GLOBAL CRISES, Global Law and Sustainable Development Series, Routledge Publishing (New York/London), ISBN 9781138695733, 2018, pp. XVII - XXI.

[5] As noted in the recent United Nations survey, the digital strategies of governments can be even in many respects decisive for the fulfilment of Sustainable Development Goals. See United Nations e-Government Survey: Gearing e-Government to Support Transformation Towards Sustainable and Resilient Societies XXV-XXVII (2018),

artificial intelligence (AI) or blockchain as sources of resilience can prove to be decisive at the times of emergency as well as in the day-to-day business.[6]

When looking at the ICT's developments through the perspective of sustainable development, it is interesting to note that they are quite likely to succeed in settings in which the traditional way of doing things is non-existent or inefficient. For instance, ICT technologies in the South Kivu area in the Democratic Republic of Congo enable communities to communicate with government. The measures and projects falling under the scope of e-Government in developing countries, often undergoing a stage of societal transition, have a potential to enhance the inclusiveness.[7] Some argue that the emergence of internet, and increased and essentially equal communication channels it provides, has also a potential to reduce the risk of conflicts in a society.[8] Another example is the city Porto Alegre in Brazil that developed a participatory budgeting system enabling to exchange views and make decisions on a variety of public services and the use of government's budget.[9]

The core of this article will be dedicated to the blockchain technology. For this reason, we will dedicate few lines to describe how this technology works and why it has been considered revolutionary by many. The birth of the blockchain technology is associated with the anonymous character of Satoshi Nakamoto, who used it to create the Bitcoin cryptocurrency.[10] This technology finds its application mainly in settings requiring trust and authentication. Contrary to centralized

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https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2018-Survey/E-Government%20Survey%202018_FINAL%20for%20web.pdf (last updated Feb. 19th, 2019).

[6] United Nations e-Government Survey: Gearing e-Government to Support Transformation Towards Sustainable and Resilient Societies 4 (2018), https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2018-Survey/E-Government%20Survey%202018_FINAL%20for%20web.pdf (last updated Feb. 19th, 2019).
When thinking about the security concerns associated with these emerging technologies, governments need to address multiple issues. For instance, the discussion about cloud computing and blockchain can incite also the discussion about geographical location of servers. See Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 362 (2017).

[7] United Nations e-Government Survey: Gearing e-Government to Support Transformation Towards Sustainable and Resilient Societies 9 (2018), https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2018-Survey/E-Government%20Survey%202018_FINAL%20for%20web.pdf (last updated Feb. 19th, 2019).

[8] John Hoffman, Saul Alamilla & Belle Liang, *The Social Contract Theory Revisited: Examining the Relationship Between Greed, Conflict, and the Evolution of Cooperation, in* THE ROLE OF COMMUNITY DEVELOPMENT IN REDUCING EXTREMISM AND ETHNIC CONFLICT 143-146 (John Hoffman et al. Springer 2018).

[9] United Nations e-Government Survey: Gearing e-Government to Support Transformation Towards Sustainable and Resilient Societies 11 (2018), https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2018-Survey/E-Government%20Survey%202018_FINAL%20for%20web.pdf (last updated Feb. 19th, 2019).

[10] Scott J. Shackelford & Steve Myers, *Block-by-Block: Leveraging the Power of Blockchain Technology to Build Trust and Promote Cyber Peace*, 19 THE YALE JOURNAL OF LAW & TECHNOLOGY 335, 338 (2017).

databases, blockchain is characterized by its decentralized nature.[11] This enables to store information at various computers participating in the scheme. All the information is stored at all computers and participants have access to it, while the information is protected by the means of digital signatures and public key cryptography. The benefits of a distributed ledger concept based on the peer-to-peer network from the perspective of resilience and security is that it reduces the risk of manipulation, hacker attack or any other form of system failure.[12] Another strength and key feature of blockchain is transparency.[13] It is possible to add the next transactions, while previous information is not erased, i.e. the history can be tracked. Any new transaction is validated by the means of a consensus by the participants in the peer-to-peer network in a form of a distributed consensus protocol. The validation is a mechanism providing transactions with legitimacy. The decision on such transaction is then stored in a block, which is added to the line of transactions. The creation of these blocks is the process known as mining. The etymological analysis of the term blockchain can help us to understand the meaning of these blocks. Blockchain stands for the blocks linked in a form of a chain. While the latest block represents always the latest, up-to-date version of blockchain, each block contains also the hash of prior block. This form of historical continuance and "collective memory"[14] is relevant from the perspective of

[11] Interpreting the words of Albert Wenger, "blockchains [are] logically centralized (there is only one ledger) but organizationally decentralized (many entities maintain copies of that ledger)." See Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 11 (2018).

[12] Even though the risk is reduced, it does not mean that it is non-existent. The blockchain technology can be for example vulnerable to Man-in-the-Middle Attacks, which can occur when someone secretly intrudes in the communication between two participants and manipulates their communication without them realizing it. Further danger represents also the Denial-of-Service attack, based on sending multiple requests to the system to disrupt the ordinary communication and make it unresponsive. The so-called Sybil attack takes place when the attacker intrudes the blockchain network with computers under his control. In this way, the computers in the network can connect to these computers and the attacker may gradually conquer the network and dictate its activities. See Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Answer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 128-29 (2016); see also Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 355-56 (2017).
The frameworks putting emphasis on the creation of trustworthy profiles and good reputation, also in the terms of time and energy needed to establish such profiles, such as the Bitnation framework, are less susceptible to Sybil attacks. See Susanne Tarkowski Tempelhof et al., *Pangea Jurisdiction and Pangea Arbitration Token (PAT): The Internet of Sovereignty* 26, 30 (April 2017), https://tse.bitnation.co/documents/ (last updated March 9th, 2019).
With respect to the Sybil attack it is also beneficial to mention the so-called Byzantine Generals Problem, which articulates a situation in which the attacker establishes a false consensus between nodes. This can happen even in a situation, in which the majority of real users is honest. See Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 12 (2018).

[13] Scott J. Shackelford & Steve Myers, *Block-by-Block: Leveraging the Power of Blockchain Technology to Build Trust and Promote Cyber Peace*, 19 THE YALE JOURNAL OF LAW & TECHNOLOGY 335, 340 (2017).

[14] Susanne Tarkowski Tempelhof et al., *Pangea Jurisdiction and Pangea Arbitration Token (PAT): The Internet of Sovereignty* 29 (April 2017), https://tse.bitnation.co/documents/ (last updated March

transparency, as it enables to identify the information and guarantee the data integrity.[15] The issue of the so-called double-spending[16] is in this context avoided by the need to obtain a consensual agreement of nods, computers, participating in the network, to "approve the order of the transactions."[17] The above-mentioned description of the blockchain technology is based on the so-called Nakamoto Consensus, which "means that participants in a network have confidence that their ledgers are both accurate and consistent."[18]

As mentioned above, the emergence of the blockchain technology is associated with the cryptocurrency Bitcoin, which is an example of the application of technology in a manner going, with little exaggeration, beyond regulators' wildest dreams. Cryptocurrencies powered by blockchain technology have been seen also as a channel to bypass official payment systems. For instance, some argue that the initiative of the US government to block contributions to Wikileaks prompted the revolutionary-driven tech-savvy public to perceive Bitcoin as "an alternative payment system."[19] Rather ironically for a technology reputation of which is based on its alleged ability to enhance trust and resilience, cryptocurrencies using the blockchain technology have been also linked to criminal activities and the cryptocurrency market is regularly hit with rather unpredictable fluctuations.[20] As noted by Werbach, this experience should serve as an incentive for a discussion about the ways how to harness and regulate the technology.[21] The anonymous and geographically essentially unrestrained nature[22]

9th, 2019).

[15] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 355-56 (2017); see also Scott J. Shackelford & Steve Myers, *Block-by-Block: Leveraging the Power of Blockchain Technology to Build Trust and Promote Cyber Peace*, 19 THE YALE JOURNAL OF LAW & TECHNOLOGY 335, 340-46 (2017).

[16] Double spending means simply that the same amount of money is spent twice, which is almost impossible when performing physical transactions, but can theoretically happen in a digital world. In digital realm, it is theoretically possible to "copy the transaction and rebroadcast it." Blockchain system based on recording transactions and confirmation mechanisms requiring consensus can prevent such situation from happening. See Blockchain Council, *How Bitcoin is Solving the Problem of Double-Spending in the Finance Sector?* (Nov. 3rd, 2018), https://www.blockchain-council.org/blockchain/how-blockchain-is-solving-the-problem-of-double-spending-in-the-finance-sector/ (last updated March 11th, 2019).

[17] Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Anwer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 121 (2016).

[18] Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 12 (2018).

[19] Wessel Reijers & Fiachra O'Brolcháin & Paul Haynes, *Governance in Blockchain Technologies & Social Contract Theories, in* 1 LEDGER 134, 140 (2016).

[20] Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Anwer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 118 (2016).

[21] Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 4 (2018).

[22] However, in this regard it is important to note that the decentralized nature of the Bitcoin is not completely free of (and can be even compromised) by jurisdictional constraints. The Bitcoin depends on the computing power of mining and there are reports of Bitcoin mines in China producing 1,5 Mil. in Bitcoins per month. These mines are "estimated to control 3 percent of the total BitCoin

of cryptocurrency transactions powered by the blockchain technology has made cryptocurrencies an attractive channel for illicit transactions or financing of terrorism. For example, ISIS was in 2015 suspected of transferring funds by the means of cryptocurrencies.[23] Moreover, the nature of cryptocurrencies as "alternative payment systems" has inspired the governments of countries targeted by sanctions, such as Venezuela, to explore their potential by developing their own cryptocurrencies.[24] The efforts to regulate cryptocurrencies and to facilitate blockchain technology are observable in Putin's Russia as well.[25] Apart from the renegade, unpredictable or even illicit–generally not that pleasant–use, cryptocurrencies can have also positive application. For example, they can eventually contribute to a better financial inclusion of people in developing or unstable countries. Citizens of the countries with official currencies vulnerable to inflation due to a variety of reasons, such as Argentina or Venezuela, can resort to cryptocurrencies out of doubts about the reliability of their own currencies or for the sake of performing informal transactions without State-supervised or State-run intermediaries.[26] Cryptocurrencies have diverse use. From the perspective of public administration, Ethereum is a very interesting instrument, which can be utilized as a platform for smart contracts serving various general purposes.[27]

The technologies such as blockchain are being used also in the countries of the European Union. For example, in Finland, they can contribute to the verification of identities in the asylum applications and processes leading to the granting of residence permits. Moreover, they contribute also to a better financial inclusion of refugees,[28] with identity verification systems simplifying access to

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distributed network." See Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Answer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 127 (2016).

[23] Chris Telley, *A Coin for the Tsar: The Two Disruptive Sides of Cryptocurrency* 2 (April 16th, 2018), https://calhoun.nps.edu/handle/10945/57991 (last updated March 10th, 2019).

[24] On the specifics of cryptocurrency regulation and anti-money laundering approaches in various countries, see Daniel Holman & Barbara Stettner, *Anti-Money Laundering Regulation of Cryptocurrency: U.S. and Global Approaches* 26-39 (Allen & Overy), http://www.allenovery.com/publications/en-gb/Documents/AML18_AllenOvery.pdf (last updated Feb. 22nd, 2019).

[25] Chris Telley, *A Coin for the Tsar: The Two Disruptive Sides of Cryptocurrency* 1-7 (April 16th, 2018), https://calhoun.nps.edu/handle/10945/57991 (last updated March 10th, 2019).

[26] The preconditions for downloading a digital wallet and plugging in a global system is possession of a computer or mobile phone. Digital wallet can represent an alternative to a bank account, which can prove to be a safer option in the context of a country without properly functioning banking system and overreliance on cash payments. See Brett Scott, *How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance?,* UNRSID Working Paper No.2016-1 6-7 (United Nations Research Institute for Social Development), http://hdl.handle.net/10419/148750 (last updated Feb 22nd, 2019).

[27] Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 10 (2018).

[28] Blockchain-based ID for stateless people and refugees has been provided for example also by the Bitnation Refugee Emergency Response. Bitnation was awarded also the Grand Prix and the UNESCO Award for Best Idea at NETEXPLO event for this software. See Susanne Tarkowski Tempelhof et al., *Pangea Jurisdiction and Pangea Arbitration Token (PAT): The Internet of Sovereignty* 5 (April 2017), https://tse.bitnation.co/documents/ (last updated March 9th, 2019).
The Bitnation's concept assumes that biometrics is included in the blockchain, which is then

loans and social welfare.[29] However, the Nordic country that managed to establish its reputation as a front-runner in applying new technologies in the field of public administration is Estonia. The concept of digital identity has been materialized in the form of the so-called e-Residency, which is a concept of "a government-authenticated, transnational digital identity that one can use to remotely establish and run a business, open a bank account, transfer funds, and engage in trade."[30] In this way, the small nation of ca. 1.3 mil. people physically living in Estonia[31] has attempted to virtually expand its population and enable people from the whole world to digitally participate in the business and commercial life with the backing of "a sovereign government-backed identity credential."[32] In this regard, one needs to consider that being a Member State of the European Union, Estonia needs to observe the relevant European Union legislation, which puts certain limitations for such endeavours. Thus, the European Union citizenship is linked to the need to have "substantial physical presence or physical connection with a member country."[33] Being aware of these limitations, one needs to also recognize that the concept of e-Residency initiative can be seen also as a step and contribution towards the establishment of a Digital Single Market. Such objective cannot be fully achieved without mutual recognition of digital identities among the Member States. Precedent in this regard can be observed as well. The Nordic countries do not owe anything to their reputation of being pioneers on this front; the example in this context represents a joint data exchange platform between Estonia and Finland, compatible with the Estonian e-Residency concept and establishing access to e-services to citizens and permanent residents of both countries.[34]

When thinking about technological developments in the field of public administration, one should keep in mind that these technological developments should enhance the trust[35] of citizens in public administration and in the ideal

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facilitated to issue ID card and debit card. See Emilio Mordini, *Biometric Identifiers for Refugees: Political Context and Ethical Challenges* 6, https://www.keesingtechnologies.com/wp-content/uploads/2016/10/KJD51_Mordini_copyright.pdf (last updated March 10th, 2019).

[29] United Nations e-Government Survey: Gearing e-Government to Support Transformation Towards Sustainable and Resilient Societies 41 (2018), https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2018-Survey/E-Government%20Survey%202018_FINAL%20for%20web.pdf (last updated Feb. 19th, 2019).

[30] Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 474 (2017).

[31] World Population Review, *Estonia Population 2019*, http://worldpopulationreview.com/countries/estonia-population/ (last updated March 9th, 2019).

[32] Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 470 (2017).

[33] This view of the European Union citizen is present for example in the 1995 Data Protection Directive as well as in the General Data Protection Directive, superseding the previous legislation. See Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 478 (2017).

[34] Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 471 (2017).

[35] The authors of the paper on the use of the blockchain technology with respect to land registry systems use the definition of trust as enshrined in the Merriam Webster dictionary: According to this definition, trust is "assured reliance on the character, ability, strength, or truth of someone or

scenario also improve their participation possibilities. Transparency and collaboration are some of the core elements for the establishment of trust among citizens and governments.[36] The essential element of social cohesion is trust. As noted by Scott, even the everyday commercial exchange in our highly complex societies is owed to "institutionalized trust system."[37] Transactions between strangers lacking trust in each other are compensated through the trust in "a higher-order third party guarantor."[38]

The underlying philosophical concept in this regard represents the concept of social contract, which has been a subject of interest for philosophers such as Hobbes or Rosseau. Essentially, social contract is based on the idea that people as the source of power in the state delegate certain rights on governments. In exchange for the loss of rights, governments shall secure the basic tenets of their existence, such as security and liberty.[39] It is questionable, whether the existing governance structures are capable of accommodating and addressing the complexity of the today's world, exacerbated by technological developments, in a manner corresponding and complying with the philosophical underpinnings of social contract theories.[40] The overreliance on technologies without considering the philosophical underpinnings and broader implications can exacerbate the processes leading to the diminishing role of citizens in government.[41] According to Hobbes, people would live in a desolate state without trust and certainty without a social contract. The long-term dire perspective of living in this state justifies the delegation of part of their rights and competences on the Leviathan, represented in his view by an omnipresent government. Even though the initial state in the perspective of Rosseau was not a hopeless state, social contract is the expression of the need to regulate the man-made institutions such as money and private

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something [...] one in which confidence is placed [...] a charge or duty imposed in faith or confidence or as a condition of some relationship [...] something committed or entrusted to one to be used or cared for in the interest of another." See Merriam Webster, *Trust, Merriam Webster Online Dictionary*, https://www.merriam-webster.com/dictionary/trust (last updated Feb. 28th, 2019), in Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Anwer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 112 (2016).

[36] United Nations e-Government Survey: Gearing e-Government to Support Transformation Towards Sustainable and Resilient Societies 5 (2018), https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2018-Survey/E-Government%20Survey%202018_FINAL%20for%20web.pdf (last updated Feb. 19th, 2019).

[37] Brett Scott, *How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance?,* UNRSID Working Paper No.2016-1 14 (United Nations Research Institute for Social Development), http://hdl.handle.net/10419/148750 (last updated Feb 22nd, 2019).

[38] Ibid. See also Guillaume Chapron, *The Environment Needs Cryptogovernance*, 545 NATURE 403, 403 (2017).

[39] Wessel Reijers & Fiachra O'Brolcháin & Paul Haynes, *Governance in Blockchain Technologies & Social Contract Theories, in* 1 LEDGER 134, 138 (2016).

[40] Susanne Tarkowski Tempelhof et al., *Pangea Jurisdiction and Pangea Arbitration Token (PAT): The Internet of Sovereignty* 12 (April 2017), https://tse.bitnation.co/documents/ (last updated March 9th, 2019).

[41] MARGARET STOUT AND JEANNINE LOVE, A RADICALLY DEMOCRATIC RESPONSE TO GLOBAL GOVERNANCE (Routledge 2016).

property by the means of government.[42] The intriguing study of Reijers et al., subjecting the blockchain technology to scrutiny from perspective of philosophical theories mentioned above, explored the notion of trust as well. While trust was seen as the defining element of the almost "heavenly" state of nature by Rosseau, the emergence of the need for blockchain is associated rather with the understanding that trust in man-made relations is inherently flawed.[43] By contrary, the *quid pro quo* nature of the Hobbesian world seeing human beings and man-made relations as prone to moral flaws and self-interest seem to correspond more to the nature and demands associated with the blockchain technology.[44] Blockchain enables to "have confidence in transactions without trusting the integrity of any individuals, intermediaries, or governments."[45] Technological developments powered by blockchain technology relevant from the perspective of public administration, such as land registries, prove to be useful in the context of the countries with weak institutions. In a situation where the government is not able to fulfil its basic functions, the elementary social contract based on trust begin to crumble. However, the paradox noted by Scott in this regard is that even though blockchain technology can be very useful in replacing traditional institutions in such settings, their social and institutional reality will make the effective implementation of such technologies difficult as well.[46] Moreover, it is far-fetched to think that the technologies such as blockchain will miraculously remedy the shortcomings inherent in a man-made world, such as fraud or corruption[47] and the lack of trust resulting therefrom. Even though these technologies have a potential to enhance trust by improving control and auditing mechanisms, conditions for the creation of trust and causes for the lack of it need to be addressed in the first place in a man-made world. As noted earlier in the text, properly functioning institutional

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[42] Wessel Reijers & Fiachra O'Brolcháin & Paul Haynes, *Governance in Blockchain Technologies & Social Contract Theories, in* 1 LEDGER 134, 139-142 (2016).

[43] Wessel Reijers & Fiachra O'Brolcháin & Paul Haynes, *Governance in Blockchain Technologies & Social Contract Theories, in* 1 LEDGER 134, 140 (2016).

[44] Wessel Reijers & Fiachra O'Brolcháin & Paul Haynes, *Governance in Blockchain Technologies & Social Contract Theories, in* 1 LEDGER 134, 141 (2016).

Scott in his dim scenario resembled his vision of a blockchain-driven society to the so-called Techno-Leviathan. See Brett Scott, *Visions of a Techno-Leviathan: The Politics of the Bitcoin Blockchain.* Rosa Luxembourg Stiftung Policy Paper 02/2015 3-4 http://www.rosalux.de/publication/41131/visions-of-a-techno-leviathan.html (last updated Feb. 22nd, 2019); see also Brett Scott, *How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance?,* UNRSID Working Paper No.2016-1 13 (United Nations Research Institute for Social Development), http://hdl.handle.net/10419/148750 (last updated Feb 22nd, 2019).

[45] Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 3 (2018).

[46] See Brett Scott, *How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance?,* UNRSID Working Paper No.2016-1 11-12, 17 (United Nations Research Institute for Social Development), http://hdl.handle.net/10419/148750 (last updated Feb 22nd, 2019).

[47] However, as noted by Kshetri, the use of blockchain technology will make it harder for corrupt public officials to hide their corrupt practices. See Nir Kshetri, *Will Blockchain Emerge as a Tool to Break the Poverty Chain in the Global South*, THIRD WORLD QUARTERLY 1, 10 (2017)

setting is a necessary precondition not only for successful implementation of blockchain-based technologies, but for establishing trust as a necessary tenet of a social contract as well.[48] The technology can improve the resilience of the government against external threats; however, genuine trust is and remains the precondition for resilience of a society and its institutions in general.[49] In this regard, it is valuable to recall, according to Werbach, Russian proverb "if you trust, you won't insist on verifying, whereas if you insist on verifying, clearly you don't trust", implying the need to establish trust on a basis going beyond the mere technical verification.[50] As noted by Stout, interpreting *inter alia* the words of Mary Parker Follet, properly functioning social contract requires also "an authentic sharing of experience."[51]

In this way, we come closer to one of the crucial underlying questions revolving around blockchain technology and social contract theory. Should–in a far-fetched scenario–a social contract be based on blockchain, i.e. should blockchain become the basic tenet of governance? Or should, in a more realistic scenario, institutions harness the blockchain technology and guide its implementation and define its role in governance? In both scenarios, the reality of the social contract in a blockchain setting might render dire results from the viewpoint of democratic governance. It is not that difficult to imagine experts, especially in the context of repressive regimes, who can "dictate the rules in which the application governs the users."[52] The design of the blockchain platforms and the rules governing them are essential. Social contract theories also assume that rules and laws are precondition for the existence of civilization based on a rational dialogue.[53] This challenge is to a certain extent relevant also for government-led blockchain platforms. The essentials of the blockchain technology make it naturally attractive and interesting for specific sorts of people. For example, the experts, who are always a minority, can get in a position to dictate the rules to the others.[54] Miners, whose computers provide the fuel for the whole blockchain

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[48] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 360 (2017).

[49] John Hoffman, Saul Alamilla & Belle Liang, *The Social Contract Theory Revisited: Examining the Relationship Between Greed, Conflict, and the Evolution of Cooperation, in* THE ROLE OF COMMUNITY DEVELOPMENT IN REDUCING EXTREMISM AND ETHNIC CONFLICT 141 (John Hoffman et al. ed. Springer 2018).

[50] Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 6 (2018).

[51] MARGARET STOUT AND JEANNINE LOVE, A RADICALLY DEMOCRATIC RESPONSE TO GLOBAL GOVERNANCE (Routledge 2016).

[52] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 359 (2017).

[53] John Hoffman, Saul Alamilla & Belle Liang, *The Social Contract Theory Revisited: Examining the Relationship Between Greed, Conflict, and the Evolution of Cooperation, in* THE ROLE OF COMMUNITY DEVELOPMENT IN REDUCING EXTREMISM AND ETHNIC CONFLICT 137 (John Hoffman et al. Springer 2018).

[54] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION

system, are by nature interested more in profit.[55] This fact is of importance also from the perspective of the security and resilience of blockchain, as the reduced activity of miners–for instance, in the case of fluctuations at the cryptocurrency market–makes the whole system more vulnerable to attacks.[56] It is the question of design whether the technology will be beneficial for the public or just for the few and which values it will promote to implement or not.[57] It is interesting to note that the underlying nature of the blockchain technology as articulated for example in its Bitcoin version is essentially "censorship and tamper-resistant."[58] In the democratic context, the application and the strategy to apply and implement blockchain technology in government-related settings need to be accompanied by a discussion between experts and policy-makers "to ensure compliance with public values and societal needs."[59] One of the questions that should be addressed when applying the blockchain technology in a government-related context is also the degree to which the public can participate in the blockchain platforms. The level of technological literacy as well as other relevant concerns, such as privacy or control, determine the degree of participation in the blockchain.[60] For example, policy makers in the European Union need to comply with the European General Data Protection Regulation (GDPR), enshrining also the right of users to view, change and remove data.[61] As noted by Sullivan and Burger, "locating identity documents and information on blockchain is clearly "processing" and the individual e-Resident is the "data subject" as defined under both the 1995 [Data Protection] Directive and the GDPR."[62]

The addressing of technical issues associated with government-led implementation of blockchain technology needs to go hand in hand with their implications for the society. Going one step further from their practical utilization, the designers of these programmes and platforms need to keep in mind their impact

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QUARTERLY 355, 363 (2017).

[55] Scott J. Shackelford & Steve Myers, *Block-by-Block: Leveraging the Power of Blockchain Technology to Build Trust and Promote Cyber Peace*, 19 THE YALE JOURNAL OF LAW & TECHNOLOGY 335, 349 (2017).

[56] Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 24-25 (2018).

[57] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 363 (2017).

[58] Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 15 (2018).

[59] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 359 (2017).

[60] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 360 (2017).

[61] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 361 (2017).

[62] Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 478 (2017).

on democracy as well. The social contract based on democratic governance is not given and is not "inherent in human nature."[63] The positive impact can only be felt as real if it is able to engage citizens and accommodate their participation rights, which are the tenets of democratic practice.[64] This understanding should be reflected also in the realm of technology and its utilization in man-made world.

II. FROM THEORY TO PRACTICE: PRACTICAL APPLICATION OF THE BLOCKCHAIN TECHNOLOGY

In practice, the blockchain technology enabling secured transactions between a variety of parties can be applied in a variety of settings and improve various public administration tasks and enhance the work of the government. One of its characteristic features is the so-called immutability, i.e. the ability to create "permanent, unchangeable records."[65] The example provided earlier in the text mentioned the ability of blockchain technology to reform and enhance the registry of land titles.[66] In this regard, blockchain technology can help to prevent fraud in the cases of transfer of land ownership and help to "clarify the authenticity of the title."[67] Apart from that example, Ølnes et al. mention in their article a variety of real-life scenarios. For instance, the organization of mass events on the streets of towns and cities is based on permits presupposing the agreement between municipality, police or fire brigades.[68] It can be also useful in the cases involving "birth and marriage certificates, vehicle registries, (business) licenses, educational certificates, student loans, social benefits and votes."[69]

The example of land registries was mentioned because land registries based on blockchain technology are being already tested in practice. For example,

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[63] John Hoffman, Saul Alamilla & Belle Liang, *The Social Contract Theory Revisited: Examining the Relationship Between Greed, Conflict, and the Evolution of Cooperation, in* THE ROLE OF COMMUNITY DEVELOPMENT IN REDUCING EXTREMISM AND ETHNIC CONFLICT 138 (John Hoffman et al. Springer 2018).

[64] MARGARET STOUT AND JEANNINE LOVE, A RADICALLY DEMOCRATIC RESPONSE TO GLOBAL GOVERNANCE (Routledge 2016).

[65] Angela Walch, *The Path of the Blockchain Lexicon (and the Law),* 36 REV. BANKING & FIN. L. 1, 17 (2017).

[66] One of the first uses of the blockchain technology in the context of land registries is attributed to Bitnation. See Susanne Tarkowski Tempelhof et al., *Pangea Jurisdiction and Pangea Arbitration Token (PAT): The Internet of Sovereignty* 5 (April 2017), https://tse.bitnation.co/documents/ (last updated March 9th, 2019).

[67] In this regard, it can be added that blockchain technology enables to register transactions concerning land ownership and store the data related therewith. It can be useful also in disputes about land ownership "to protect the rights of the owner of the land." See Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 357 (2017).

[68] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 357 (2017).

[69] Svein Ølnes, Jolien Ubacht & Marijn Janssen, *Blochchain in Government: Benefits and Implications of Distributed Ledger Technology for Information Sharing*, GOVERNMENT INFORMATION QUARTERLY 355, 355 (2017).

the development of such land registry systems was subject of a contract between Honduras and US company Factom[70] in 2015.[71] Similar projects have been reported from Georgia or Ghana as well.[72] Blockchain technology can help to prevent land title frauds, uncertainties with respect to land titles or problems associated with double-registry of lands.[73] The problems with property rights articulated in the objective to establish a properly functioning land registry system, had been also subject of legal reforms before Honduras considered the Factom-led solution. Part of these reforms was also the creation of a technological platform serving as a basis of land registry system in Honduras. However, the ordinary technological databases had not proven to be immune to hacking and land title fraud.[74] As noted by Scott, further research (going beyond the scope of our paper) can shed light on the potential of land registries powered by the blockchain technology to contribute to a better financial inclusion of the people who would not have the possibility to get access to financing from banks without certainty about their land title that they might need to prove and use as a collateral for financing.[75] In Sweden, the blockchain-based land registry system has been associated with the simplification of real estate transactions and their enhanced transparency.[76] In her research on the use of blockchain technology in the context of land registries, Victoria Louise Lemieux adressed the challenges and limitations of its application in this context. To sum up, only the so-called hashes, copies of original records, are stored on the blockchain-based solution, while it is not possible to "reverse engineer a hash to reproduce a record."[77] Further, the trustworthiness of the records is undermined by the lack of reliability and authenticity of information stored in this way.[78] In the Factom-based system,

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[70] As noted by Victoria Louise Lemieux, the company Factom started by offering an open-source solution based on the blockchain technology. Its purpose was to create a permanent blockchain-based record. See Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Anwer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 123 (2016).

[71] Nir Kshetri, *Will Blockchain Emerge as a Tool to Break the Poverty Chain in the Global South*, THIRD WORLD QUARTERLY 1, 6 (2017).

[72] Guillaume Chapron, *The Environment Needs Cryptogovernance*, 545 NATURE 403, 404 (2017); see also Nir Kshetri, *Will Blockchain Emerge as a Tool to Break the Poverty Chain in the Global South*, THIRD WORLD QUARTERLY 1, 6-7 (2017).

[73] Brett Scott, *How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance?,* UNRSID Working Paper No.2016-1 11-12, 17 (United Nations Research Institute for Social Development), http://hdl.handle.net/10419/148750 (last updated Feb 22nd, 2019).

[74] Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Anwer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 122 (2016).

[75] Brett Scott, *How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance?,* UNRSID Working Paper No.2016-1 11-12, 17 (United Nations Research Institute for Social Development), http://hdl.handle.net/10419/148750 (last updated Feb 22nd, 2019).

[76] Gertrude Chavez-Dreyfuss, *Sweden Tests Blockchain Technology for Land Registry*, in REUTERS TECHNOLOGY NEWS (June 16th, 2016), https://www.reuters.com/article/us-sweden-blockchain/sweden-tests-blockchain-technology-for-land-registry-idUSKCN0Z22KV (last updated March 10th, 2019).

[77] Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Anwer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 120 (2016).

[78] Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Anwer?,* 26 (2)

several steps have been made to make the system useful in the context of land registries. For example, the risk of manipulation has been averted by circulating and rotating responsibilities of nodes in the system, so that no nod has a chance to gain decisive dominance over processes.[79] The limitations are present with respect to the validation of transactions. Considering the complexity of the real estate context, for instance with respect to different rules applicable to different categories of real estate buyers, blockchain-based solution is merely able "to record the process occurred rather than [fully] validate [real estate] transfers."[80] Taking into account the limitation concerning records mentioned above that it is not possible to store original records, only their hashes, it appears worthy to reiterate that these hashes cannot be reverse engineered. For the authentication of documents is then required their procession in a manner "using the same protocols and procedures originally used to process the record stored in the [blockchain] and then the two hashes must be compared to ensure that they match."[81]

The revolutionary Estonian concept of digital identity mentioned earlier in the text is also not completely without risks. Making the access to e-Residency fully global and digital as well as possibly flexible, while abstaining from the requirement to submit original documents or the requirement imposed on applicants to present themselves in person before the authorities increases the risk of obtaining a digital identity based on false data. Even if there are precautions put in place, the system can be prone to errors.[82] The fact that the e-Residency system disrupts and transforms the traditional authentication procedures - and in the end creates a channel to bypass them – cannot be automatically interpreted as an argument in favour, but also against this novel approach. There are voices pointing out in this context also the negative experience with alternative channels and systems based on new technologies, such as cryptocurrencies, and their susceptibility to being used as vehicles for money laundering or fraudulent activities. Contrary to these arguments, Estonia has relied on the benefits of the blockchain technology[83] resting in its potential to enhance security and resilience.

RECORDS MANAGEMENT JOURNAL 110, 120 (2016).

[79] Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Anwer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 124 (2016).
The security of blockchain depends to a great extent on its ability to prevent that more than fifty percent of the computing power of the network is controlled by a single entity. See Scott J. Shackelford & Steve Myers, *Block-by-Block: Leveraging the Power of Blockchain Technology to Build Trust and Promote Cyber Peace*, 19 THE YALE JOURNAL OF LAW & TECHNOLOGY 335, 355 (2017).

[80] Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Anwer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 126 (2016).

[81] Victoria Louise Lemieux, *Trusting Records: Is Blockchain Technology the Anwer?,* 26 (2) RECORDS MANAGEMENT JOURNAL 110, 127 (2016).

[82] Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 473 (2017).

[83] Some argue that talking about the Estonian approach as about an approach applying a full-fledged blockchain solution in this context is a far-fetched interpretation. Some technical observers argue that the use of the record documents hashes does not imply that Estonia is using a full-fledged blockchain technology. See Dave Birch, *Estonia, Fake News and Digital Identity* (March 20th, 2017),

In its collaboration with Bitnation[84], Estonia introduced and improved for instance the system of electronic Public Notary, enabling e-Residents to authenticate their official documents, such as business contracts or birth certificates.[85] The consensual nature of the blockchain-enabled verification requires the consensus of nods to determine person's identity.[86] The questions arise, inter alia, whether this form of identity verification is sufficient and reliable, considering the possibility of creating "a new digital identity and in effect, a new legal identity, which in reality is without lawful basis and which could be used to hide real identity."[87] To balance this shortcoming, Sullivan and Burger propose that the blockchain-based solution for verifying identity is seen as complementary to already existing national and international standards compatible with international law and having basis in national legislation of respective countries (and vice versa). As the above-mentioned authors note, "although facts are recognized within the blockchain as being valid, they are not legally binding."[88] Paradoxically, the disruption of traditional authentication procedures through the blockchain technology, which, as mentioned earlier, can be prone to errors, can prove to be beneficial from the perspective of security as well. The shared use of blockchain in the field of public administration and in the interaction with intermediaries can reduce the need to separately upload and store a scan of official documents by each of the respective bodies, provided that it is based on a "secure form of public key infrastructure."[89] As noted by Leonhard, such system could be only fraudulently disrupted if one manages to engage a great number of nods before an authentication process requiring consensus is completed, which is only hardly possible.[90] It is also worthy to mention that to protect its critical infrastructure, Estonia makes also use of the

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https://www.chyp.com/estonia-fake-news-and-digital-identity/ (last updated March 13th, 2019), in Angela Walch, *The Path of the Blockchain Lexicon (and the Law),* 36 REV. BANKING & FIN. L. 1, 29-30 (2017).

[84] Through their collaboration, Estonia provided Bitnation with certain form of legitimacy. For this reason, it is beneficial to dedicate few words to its vision. According to its White Paper, "Bitnation's vision is a global free market for governance services [where] you can become a Citizen of any Nation through smartphone application." Bitnation's vision offers a fundamentally different, almost utopian, concept of governance and a profound shift from Nation states to decentralized forms of governance and global jurisdiction. See Susanne Tarkowski Tempelhof et al., *Pangea Jurisdiction and Pangea Arbitration Token (PAT): The Internet of Sovereignty* 4, 11-12 (April 2017), https://tse.bitnation.co/documents/ (last updated March 9th, 2019).

[85] Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 474 (2017).

[86] Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 475 (2017).

[87] Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 476 (2017).

[88] Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 477 (2017).

[89] Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 477 (2017).

[90] Robert D. Leonhard, *Developing Renewable Energy Credit As Cryptocurrencies on Ethereum's Blockchain* 7 (Nov. 30th, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2885335 (last updated March 10th, 2019).

so-called Keyless Signature Infrastructure based on similar principles as mentioned earlier in the text.[91]

Blockchain technology is also associated with the concept of smart contracts that are executed automatically "when particular conditions are met."[92] Werbach makes use of the description of smart contracts as "autonomous software agents."[93] Eventually, this technology can also foster energy security and independence and empower the communities relying on renewable sources of energy. The application of the blockchain technology could enable direct, affordable and reliable trading between participants in the energy networks.[94] Blockchain technology can transform the energy market and make it more participatory. Contrary to centralized systems based on large power plants distributing energy to customers, blockchain technology enables to establish decentralized energy networks involving small number of people generating, distributing and trading energy. These small networks, microgrids, can empower participants by delegating decision-making about the production and distribution of energy on them. This system can also prove to be important from the perspective of energy security, considering that they can step in in the case of power outages concerning the main energy sources.[95] These developments can be seen in the light of enhanced use of distributed energy resources transforming "the role of households and local communities […] from passive consumer to active prosumers."[96] The peer-to-peer nature of the energy networks based on the blockchain technology could enable to transfer energy by the means of virtual coins within blockchain platforms created for this purpose without third-party intermediaries.[97] This peer-to-peer nature can prove to be competitive advantage in comparison to other forms of local energy systems that have to rely on third-party actors.[98] A blockchain protocol implementing smart contract[99] features can

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[91] Scott J. Shackelford & Steve Myers, *Block-by-Block: Leveraging the Power of Blockchain Technology to Build Trust and Promote Cyber Peace*, 19 THE YALE JOURNAL OF LAW & TECHNOLOGY 335, 364 (2017); see also E-Estonia, *KSI Blockchain*, https://e-estonia.com/solutions/security-and-safety/ (last updated March 10th, 2019).

[92] Guillaume Chapron, *The Environment Needs Cryptogovernance*, 545 NATURE 403, 404 (2017); see also Robert D. Leonhard, *Developing Renewable Energy Credit As Cryptocurrencies on Ethereum's Blockchain* 8 (Nov. 30th, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2885335 (last updated March 10th, 2019).

[93] Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 16 (2018).

[94] Guillaume Chapron, *The Environment Needs Cryptogovernance*, 545 NATURE 403, 404 (2017).

[95] Esther Mengelkamp et al., *Designing Microgrid Energy Markets. A Case Study: The Brooklyn Microgrid*, 210 APPLIED ENERGY 870, 871 (2018).

[96] Binod Koirala & Rudi Hakvoort, *Integrated Community-Based Energy Systems: Aligning Technology, Incentives, and Regulations, in* INNOVATION AND DISRUPTION AT THE GRID'S EDGE 363 (Fereidoon P. Sioshansi Ed. Elsevier 2017).

[97] Esther Mengelkamp et al., *Designing Microgrid Energy Markets. A Case Study: The Brooklyn Microgrid*, 210 APPLIED ENERGY 870, 873 (2018).

[98] Binod Koirala & Rudi Hakvoort, *Integrated Community-Based Energy Systems: Aligning Technology, Incentives, and Regulations, in* INNOVATION AND DISRUPTION AT THE GRID'S EDGE 368 (Fereidoon P. Sioshansi Ed. Elsevier 2017).

[99] This technology is associated mainly with the Ethereum blockchain. See Robert D. Leonhard,

facilitate the trading and transfer of energy between trusted participants in a secure manner.[100] It is questionable whether these forms of energy microgrids could economically compete with traditional energy distribution networks and sources.[101] However, as noted by Esther Mengelkamp et al., the economic incentives could be in certain constellations supplemented with other motivations of more philosophical nature, for example by the ambition to establish a self-sufficient community generating its own renewable energy.[102] Considering that the issues of decision-making, incentives and operation have been listed as the main challenges for local energy systems, these developments can prove to be quite ground-breaking.[103] An example represents for instance the Brooklyn Microgrid project, which implements a smart contract system enabling to trade energy and transfer data about consumption and generation of energy between participants.[104] However, the implementation of such technologies and projects on a wider scale might require changes in respective laws and policies creating incentives for their introduction and compensating for the eventual lack thereof.[105]

III. CONCLUSION

When we outlined as the broader goal of the article the discussion about the implications of the emerging technologies, such as blockchain, from the perspective of sustainable development and their ability to address societal needs, we implicitly recognized the need to address broader ramifications of such technologies as well. As noted by Stout, the challenges of our times make the need for the reform of our governance systems more and more acute. The situation will push us to become "planetary citizens" and our societies might be compelled to adopt features of "integrative governance."[106] Public administration will be in the

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Developing Renewable Energy Credit As Cryptocurrencies on Ethereum's Blockchain 9 (Nov. 30th, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2885335 (last updated March 10th, 2019).

[100] Esther Mengelkamp et al., *Designing Microgrid Energy Markets. A Case Study: The Brooklyn Microgrid*, 210 APPLIED ENERGY 870, 874 (2018).

[101] In this regard it is interesting to note that distributed energy networks and markets hide according to Goldman Sachs also major economic opportunities. According to its estimate, this opportunity can be calculated at $ 2,5 - $ 7 billion annually. See Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 18 (2018).

[102] Esther Mengelkamp et al., *Designing Microgrid Energy Markets. A Case Study: The Brooklyn Microgrid*, 210 APPLIED ENERGY 870, 875 (2018).

[103] Binod Koirala & Rudi Hakvoort, *Integrated Community-Based Energy Systems: Aligning Technology, Incentives, and Regulations, in* INNOVATION AND DISRUPTION AT THE GRID'S EDGE 364 (Fereidoon P. Sioshansi Ed. Elsevier 2017).

[104] Esther Mengelkamp et al., *Designing Microgrid Energy Markets. A Case Study: The Brooklyn Microgrid*, 210 APPLIED ENERGY 870, 876 (2018); see also Binod Koirala & Rudi Hakvoort, *Integrated Community-Based Energy Systems: Aligning Technology, Incentives, and Regulations, in* INNOVATION AND DISRUPTION AT THE GRID'S EDGE 380 (Fereidoon P. Sioshansi Ed. Elsevier 2017)..

[105] Binod Koirala & Rudi Hakvoort, *Integrated Community-Based Energy Systems: Aligning Technology, Incentives, and Regulations, in* INNOVATION AND DISRUPTION AT THE GRID'S EDGE 372 (Fereidoon P. Sioshansi Ed. Elsevier 2017).

[106] MARGARET STOUT, A RADICALLY DEMOCRATIC RESPONSE TO GLOBAL GOVERNANCE (Routledge

need of reform as well. On the one hand, there will be a pressure to make it more participatory; on the other hand, there will be a pressure for modernization and digitalization. Recalling the introduction of the paper, Muhammad will inevitably come to the mountain or vice versa in this context, the question is only what will be the outcome of this encounter. Will Mohammed die on the mountain? Will he make the mountain a habitable place? Or will they both vanish in a storm surpassing both of them? There is still a need for further research when considering the role of the blockchain technology in this evolving context and our paper attempted to contribute to this discourse.

In this regard, we hold it for relevant to mention few remarks summing up the evolution of technological developments mentioned above and their implications. For example, it is worthy to mention the potential of the digital identity based on blockchain technology to contribute to the evolution of human rights discourse. Considering that the right to identity is a human right recognized in a variety of forms - for instance as a part of the right to privacy and personal sphere or as a part of the right to self-determination - in various international instruments, it has naturally led to the gradual expansion of this right to cover the right to digital identity as well.[107]

For those believing in the Bitnation's vision, it can be interesting the possibility to pursue legal union for same sex couples provided through blockchain-based solutions within Bitnation's framework. Bitnation in its vision appeals to human rights concerns when providing justification for the enhanced use of the blockchain technology in this setting, noting that homosexuals do not only lack having their rights secured in the legal frameworks of many countries, but they are also actively persecuted in some countries as well.[108]

The Bitnation's vision of blockchain jurisdiction relying on the reputation ranking of blockchain-based laws is a rather far-fetched vision.[109] It is questionable whether the vision of the proponents and advocates of the blockchain technology that it can create an independent system of blockchain law complementary to civil or common law will ever materialize. The implications of blockchain technology are not predictable and can be applied and interpreted in the reality of man-made world and law only with difficulties. As noted by Chapron, smart contracts based on the blockchain technology "are enforced regardless of their consequences."[110] Relying just on the technology behind smart contracts would mean that we accept

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2016).

[107] To name a few, it is worthy to mention Art.8 of the Convention on the Rights of the Child, Art.8 of the European Convention on Human Rights and Fundamental Freedoms or Art.1 of the International Covenant on Civil and Political Rights. See also Clare Sullivan & Eric Burger, *E-Residency and Blockchain*, 33 COMPUTER LAW & SECURITY REVIEW 470, 479-80 (2017).

[108] Susanne Tarkowski Tempelhof et al., *Pangea Jurisdiction and Pangea Arbitration Token (PAT): The Internet of Sovereignty* 8 (April 2017), https://tse.bitnation.co/documents/ (last updated March 9th, 2019).

[109] Susanne Tarkowski Tempelhof et al., *Pangea Jurisdiction and Pangea Arbitration Token (PAT): The Internet of Sovereignty* 15-16, 29 (April 2017), https://tse.bitnation.co/documents/ (last updated March 9th, 2019).

[110] Guillaume Chapron, *The Environment Needs Cryptogovernance*, 545 NATURE 403, 405 (2017).

being subjected to its flaws as well. Without regulation, such approach might endanger and jeopardize the values and rights the technology is designed to protect and facilitate.[111] Before we embark on a theoretical journey depicting blockchain as an autonomous legal system, it might be more practical to spend few words on its regulation. As noted by Werbach, "to achieve their monumental potential and avoid catastrophic failures, blockchain-based systems will need to integrate with the operations and institutions of the law."[112] Considering that it is still a relatively new technology, it might be wise to tame the zeal with respect to any regulatory endeavours until its pros and cons are demonstrated in practice.[113] At the same time, it should be recognized that the attempts to regulate blockchain technologies and stipulate best practice can prove to useful for instance from the perspective of cybersecurity.[114] On a practical note, it might be useful for example to create links between established contract law and smart contracts in order to make them complementary.[115]

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[111] Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 25 (2018).
[112] Kevin Werbach, *Trust, but Verify: Why the Blockchain Needs the Law?,* BERKELEY TECHNOLOGY LAW JOURNAL 1, 2 (2018).
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