Exploring the Possibilities of Blockchain Use in a Smart City

Mihai Rebrisoreanu, Cosmin Rus, Monica Leba and Andreea Ionica

***Abstract*—** In the context of the fact that blockchain is rapidly becoming the symbol of the fourth industrial revolution, 4IR, only the question of the areas where this technology can be used, remains. Thus, after using in the automotive industry, IOT, finance, health, tourism this technology cannot bypass governmental services. The influence of blockchain technology in the public sector will be largely behind the scenes, but technology has the potential to bring security, efficiency and speed to a wide range of services and processes. In this context, a way should be found for governmental agencies to incorporate the blockchain in the way they operate today. Security, efficiency and speed, the benefits of blockchain technology are easily applicable to public sector organizations, and the potential of technology explains why so many government leaders are actively exploring uses in their governments. Blockchain technology in that it is focused on decentralization and in terms of functioning is transparent can help increase the value of a smart city. From its implementation of electricity transactions to natural resource management, this technology can always find its place in the development priorities of new cities based on smart grid systems.

***Keywords*—** resource management, cryptography, transaction, data security, smart grid system

I. Introduction

AS a fundament blockchain is a registry with transaction and owner information, based on who has what, and who gives what to someone. When this information involves goods such as money or property, a consensus on data accuracy is crucial in order to prevent crime. Blockchain technology is mainly used in the context of virtual coins as bitcoin, but has much greater potential to innovate, applicable in many areas. Its advantage is that it can store a public data base protected by cryptography without needing regulation from a central authority. In other words, if adopted on a large scale, it would bring an unprecedented level of transparency, either in the private area or in the public administration.

Blockchain delivers security and security over peer-to-peer distributed networks. In order for a user to make a transaction, a request is sent to the computer network and to the dedicated (validation) machines. These computers validate the transaction and update the affected accounts. Lots of validated transactions are encrypted in encrypted blocks, containing information about the previous block, forming a chain with the history of each block, stored in redundant copies in nodes of the network.

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II. Blockchain Technology

Blockchain, essentially, is a decentralized registry, not held in one place, with many actors holding a copy that stores certain information that cannot be modified later. It is a kind of digital register in which any information entered is encrypted in mathematical formulas and each mathematical formula authenticates and validates another mathematical formula containing other encrypted data in turn. This decentralized data base contains all the information of all transactions involving value and which are encrypted on the blockchain, with the permission to verify their authenticity at any time.

The blockchain consists of a network of so-called computation "nodes". The node is a computer connected to the blockchain network and using an internet client to solve transaction validation and retransmission tasks. This node receives a copy of the block, which updates automatically when the network is logged on. It is said that nodes are digging bitcoins, but in fact, nodes compete to solve computational problems to make bitcoins. Bitcoin was the reason why the blockchain was originally created. But it is currently only recognized as the first of many applications that this technology can have.

Each block contains data, hash, and the previous block hash. What kind of information contains a block depends on what kind of blockchain it is. In the case of Bitcoin, the data refers to transactions such as the sender, the recipient and the number of bitcoins. Hash is like a unique fingerprint and has the role of identifying a block and its content. Once a block appears in the chain, its hash is calculated. As the first transaction takes place inside the block, the hash changes.

The third element a block contains is the previous block hash; thus creating a blockchain. If we had three blocks, block three would contain the block 2 information that would include block 1 information that does not contain information about the previous block because it is the first of its kind.

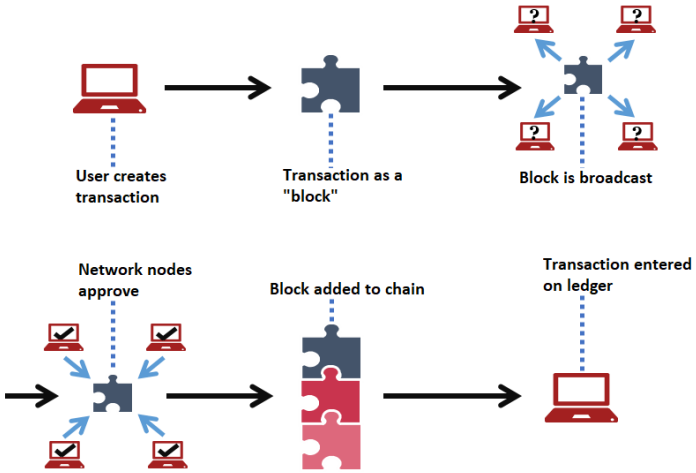

Figure 1. Blockchain principle

Another method of securing is to distribute data over a network. Thus, each user has a copy of the block chain. So, when a new block is created, each of the network participants receives the block, which is checked and, if everything is fine, is then chained. The system is based on consensus. For a block to be added to the chain, all validators must agree that that is a good block. The blockchain is not intended exclusively for transactions and crypto currency, but can be used to store medical data, collect taxes, and even be the solution for online voting.

The main benefit of blockchain technology is that information once stored can no longer be changed by anyone. There is no need to resort to classical financial institutions, there is no need to go to a bank, open an account, there will be no need for more than one document to be used. Also, if there is a need to make an international transfer, it can be done anywhere in the world in 30 seconds. All of these things can be done without paying taxes, without creating accounts, without explanations, directly from one user to another.

Another thing that technology facilitates is related to the initial public offering of coins. These are unregulated operations, similar to the public offerings of shares on stock exchanges, whereby crypto currency operators raise funds in exchange for electronic assets.

III. Blockchain and Governmental Services

In most developed and developing economies, governments are the main providers of public goods, such as justice, security, health and education, among others. This does not imply that these services are delivered directly by governments, in most cases their implementation is subcontracted to private partners for both profit and non-profit.

Next, there are presented some of the fields of use of blockchain technology.

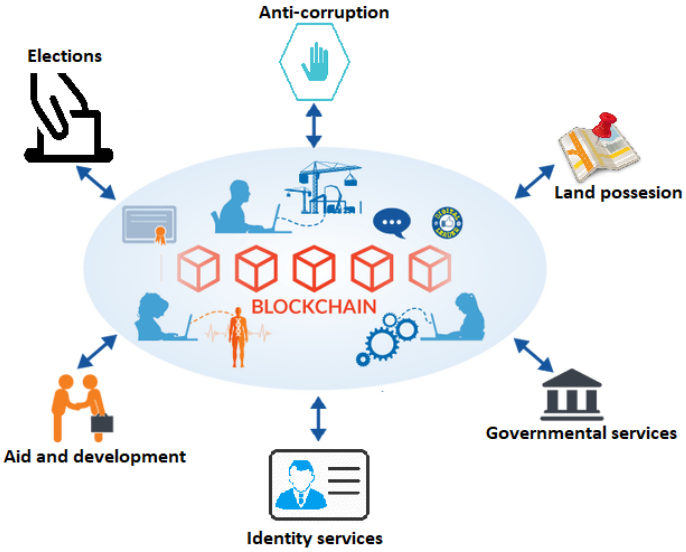

Figure 2. Fields of use of Blockchain

A. *Governmental services*

In principle, blockchain technology can be used for governmental services, involving the management and management of public documents, documents that are difficult to obtain in many developing countries. More generally, blockchain can be used to support the provision of public goods to citizens and stakeholders, especially those who require personal interaction and need personal identification. An implicit link between blockchain technology and e-Government exists, and this link is exploited by a series of startup blocks. Thus, the delivery of selected and personalized governmental services will be possible using this technology.

B. *Land possession*

Property titles have been among the first areas in which this technology could be deployed in developing countries. In 2015, the government of Honduras signed an agreement with an American startup to use the blockchain to manage the registration of property titles, as well as the management of fraud and corruption. The same thing was wanted in Ghana, Sweden, respectively.

C. *Identity services*

Many startups already work on blockchain technology for identifying services. They can design and offer multi-factor authentication and unique logging services, among others. Freedom of expression and prevention of surveillance can be favored by protecting and authenticating personal identity by using blockchain technology. This seems to be one of the most promising areas for successful application of blockchain technologies, reflected by the growing number of initiatives that work in this area. Identity detection based on blockchain technology can be used effectively for managing passports, birth and wedding certificates, national and electoral identity, and managing e-residency programs, among others. However, there are critics who claim that existing digital ID technologies work well and are more scalable than those using blockchain platforms. Indeed blocking the scalability limits of blockchain

technology could block the massive deployment of countries with large populations such as India and China.

D. Freedom of speech

Freedom of expression can be favored by distributed applications - Dapp, which aim to be a decentralized deposit of knowledge and information managed directly by end-users. This can keep censored digital content, which usually disappears quickly from the Internet. You can also design applications that can be used to comment on block blocks. In support of censorship, this technology can be used to allow journalists to use pseudonyms to protect their identity.

E. Anti corruption

The National Democratic Institute of the United States (NDI) has collaborated with BitFury, which has launched land titles in Georgia to promote anti-corruption efforts with Blockchain Trust Accelerator. The goal is to promote the development of blockchain applications that can favor open government and transparency. Launched in June 2016, there is not much information yet on how to develop the accelerator.

F. Elections

Various types of electoral processes have also benefited from the implementation and use of blockchain technologies. Distributed registers can be used to run voting processes and prevent fraud and identity theft. One of the potential advantages is that voters using blockchains can check their voting choices using their private keys at any time. Ukraine is the country that will use e-vox, a distributed registry based on Ethereum for local elections. Implementation has already begun in several cities. However, one of the main issues is access to private keys that hackers might acquire in a variety of ways, or voters could offer loans or sell their private keys in economic interest. Once it appears to be a viable method, it will be interesting to compare voting in the blockchain with the Internet vote, which is already used in Estonia.

G. New form of government

Some blockchain platforms aim to replace or at least emulate the government. The best example is Bitnation, which allows users to create their own borderless countries that offer a host of services to their citizens. These countries have their own constitution, and others provide basic incomes to its citizens.

H. Aid and development

Aid: Tech, a London company, is probably the first launch of blockchain technology that has supported humanitarian and development efforts in the Middle East. The company offers a voucher system that can be used even in the most difficult contexts and helps ensure that financial resources are safe in the final destination. Bitnation now also provides support for refugees.

IV. Blockchain and Smart City

Blockchain is currently the latest technology focused only on transparency and speed. This is the foundation of bitcoin, but it also wants to be a technology that will bring about multiple changes in several sectors of activity that are competing to develop new types of cities - smart cities based on smart grids.

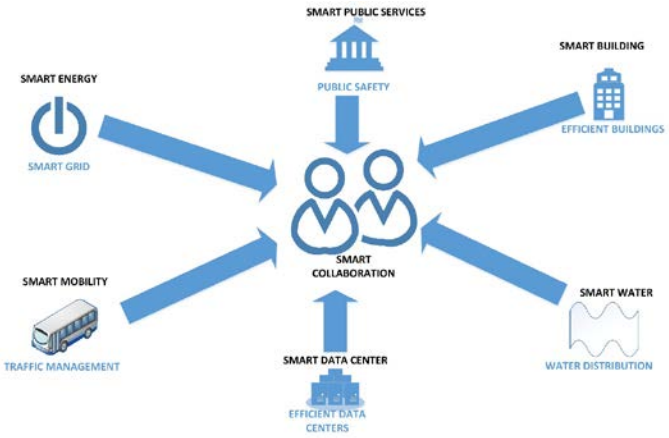

Figure 3. Smart collaboration in the context of Smart city

Blockchain technology can help build fundamental foundations in an attempt to make intelligent cities (fig.3), first by its own structure, and by eliciting any political, economic or social disruptive element in its functioning. One of the areas where blockchain technology could be used in a smart city would be to sell and buy clean energy (fig.4).

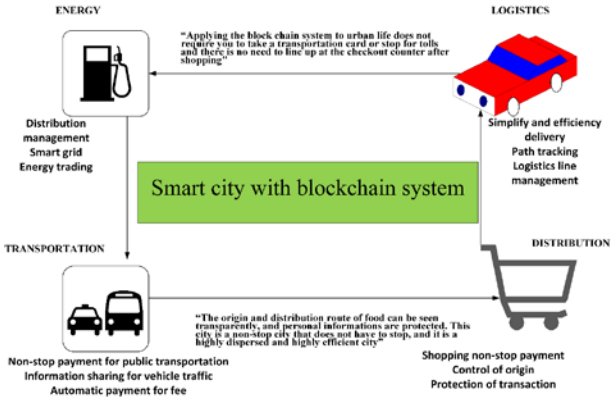

Figure 4. Blockchain in smart city

Surprisingly, in a world where the bitcoin mining consumes more electricity annually than 159 countries, there are many utilities that accept bitcoin as a payment option for electricity. Individual consumers who pay directly or through an electricity intermediary represent a major group of the total number of consumers. Although there are many suppliers of electricity, it is still at first the idea of buying genuine electric power from the manufacturer without the intervention of an intermediary through the blockchain trust chain. Another possible emerging use of cryptocurrency and blockchain is in capital growth. Initial coin offerings (ICOs) are increasingly being used to raise capital for clean energy actions. One of the most interesting uses of blockchain is security. A basic

blockchain component is a strong and unique identity, provided by public-private key encryption that is verifiable through time interactions. Applying this to automated devices with SCADA interfaces or more IoT generates a component of identity and authentication technology for the Internet of the objects and therefore for the components of the multi-scale development staircase. However, this level of security is insufficient in itself requiring additional identity providers and an authorization mechanism, but the premise is explored in several areas (fig.5).

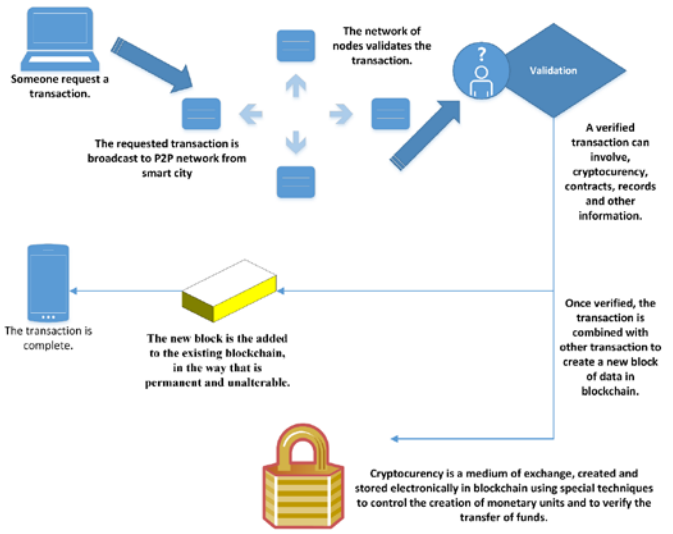

Figure 5. Link between blockchain, user and smart city

One of the most important benefit of blockchain technology is that hacking will not be any more a problem. In order to succeed in hacking, the hacker should compromise more than 50% of the system, to be able to overcome the hashing power of the target network. This is impossible, from computationally point of view it is impossible.

V. Conclusion

Blockchain technology applications from the developing countries do not yet produce major disruptions on a sustained basis. Most are supply-driven and act as independent initiatives that are not related to ongoing programs, and local institutions play a passive role, with little involvement in terms of ownership. Local economic and political challenges are still formidable and will remain so unless the implementation of blockchain technology takes a broader approach. From this point of view, the blockchain technology initiatives involved in broader intelligence governance and identity services could have the best chance of success in the medium term. Blockchain technology is still in its infancy and supported by a relatively small but very well-qualified group of innovators and techno-entrepreneurs.

Surely, blockchain technology becomes a key catalyst in delivering public goods. A pertinent question in this context would be whether blockchain is more appropriate than all other previous technologies. Certainly there is potential, but more action is needed to have a big impact on the development process.

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