

Blockchain as a Tool for Developing Countries

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Abstract

The beginning of the 21st century brings new thresholds in the field of technology, known as the Fourth Industrial Revolution (4IR). This revolution challenges the limits among physical, digital and biological spheres and, for the first time in history, human intelligence and creativity – things that were considered unique – could be, in time, substituted by robots with artificial intelligence. All of those chances will deeply reshape our way of life, national and global economy and even politics.

In this article, I will focus on how technology is going to influence developing countries, and I will discuss the case of the Information and Communication Technology for Development (ICT4D). This is a new field of the Development studies, which aims to see how devices or techniques that apply knowledge in order to process or communicate data deliver some aspects of a development agenda in a developing country. As part of the 4IR and ICT4D, I will focus on Blockchain – and on its most relevant example, Bitcoin. This is an emerging technology that strives to add value in economy by eliminating third parties from financial transactions (such as banks) and to reinforce trust between individuals that want to cooperate in a variety of social and economic fields. Consequently, my goal in this paper is to answer the following question: How can Blockchain technology's features help developing countries?

I will try to answer this question by correlating the development agenda of a developing country (consisting in economic growth, poverty and livelihoods, social development, e-Governance or environmental sustainability) with the most important features of Blockchain technology. Also, for each correlation I will find relevant examples of successfully implemented Blockchain projects. In the final part of the paper I will show how Blockchain can significantly impact the development agenda of each country that has already joined the race for economic, political and social development.

Table of Contents:

- 1. Theoretical framework: the meaning of ICT4D**
- 2. ICT4D's Agenda**
- 3. What is Blockchain as part of ICT4D**
- 4. Blockchain in developing countries**
- 5. Conclusions**

- 1. Theoretical framework: the meaning of ICT4D**

In this paper I will try to see if Blockchain is a technology that can boost developing countries to reduce the economic gap, and if it is, what are the features that make it able to do this. But in order to do this, Blockchain needs to be fit in a larger study area : ICT4D. This is the abbreviation for ‘Information and Communication Technology for Development’.

It is an academic attempt to see if the field of ITC can have any impact regarding poverty reduction in the world and if it can offer an economic boost for developing countries which are in a continuous search for policies than can reduce the gap with the developed countries. But for a better clarification of the theoretical concepts of this paper, I will discuss ICT and development separately.

First of all, I will define technology as the “devices or techniques that apply knowledge in order to complete a particular task” [1]. Then, **Information and Communication Technology is nothing more than “devices or techniques that apply knowledge in order to process or communicate data”** [1].

This is a very broad definition but it allows me to connect this field with almost all aspects of our social, political and economic life. Thus, the continuous growth of Information and Communication Technology (ICT) sector is constantly changing aspects of our life in society. “It is rapidly transforming our lives, the way we do business, access information and services, communicate with each other and entertain ourselves. It fuels the global economy. It also relates to human rights, helping – at best – to support freedom of expression and right to information according to Article 19 of the Universal Declaration of Human Rights”. [A. Kelles-Viitanen, 2003, The Role of ICT in Poverty Reduction, p. 82, <http://tanzaniagateway.org/docs/ICTroleinpovertyreduction.pdf>, accessed 12.02.2019] But all of those changes are mainly impacting the developed countries, enlarging the gap between poor and rich states at the global level.

This situation is rising the following question: if we focus on ICT implementation policies in developing countries, is it possible to give them an economic boost and reduce the gap?

There are two possible ways to answer this question. The ICT as the cure for poverty, the missing element for the developing countries, and the ICT as being unable to reach the basic needs of the poor people. **In this paper I will follow the argument of Anita Kelles-Viitanen that states “that ICT, if supported with the right policies and with cross-cutting and holistic approaches, will complement and strengthen other multisectoral efforts that are required for poverty reduction, including those meeting basic needs”** [<http://tanzaniagateway.org/docs/ICTroleinpovertyreduction.pdf>]. China could be a very good example here because it focuses a lot on the manufacturing sector of ICT (hardware and software), and, as a consequence, the employment rate in this field grew significantly.

But my explanation of ICT4D is not complete until I will define the last part of it: development. According to Richard Heeks, geographic – and agenda – specific development consists in “particular progressive changes in a developing country” [1, p. 11]. (Those particular progressive changes are also related with something more concrete – the betterment of human kind. Then, the definition of Jonathan Crush is essential for my paper: “development is about the betterment of human kind through the alleviation of poverty and the realization of human potential” [2].) Once I defined development, the ICT4D complete definition is: “the application of any entity that processes or communicates digital data in order to deliver some part of the international development agenda in a developing country” [1, p. 11].

But as Heeks states, those particular progressive changes introduced by any device that can process or communicate digital data, are related to a specific agenda. In my paper, I will understand this international development agenda as the United Nations’s (UN) Sustainable Development Goals (SDG).

2. ICT4D’s Agenda

All the Sustainable Development Goals as they are defined by the 2030 Agenda for Sustainable Development are directly related or could be easily linked with the field of ICT. (For more details, see the website of United Nations [Sustainable Development Goals.

<https://sustainabledevelopment.un.org>, last accessed 11.03.2019]. There is a total of 17 SDGs, and the most relevant goals for my research are: End poverty in all its forms everywhere; End hunger; Ensure healthy lives and promote well-being for all at all ages; Ensure inclusive and equitable quality education; Achieve gender equality and empower all women and girls; Ensure availability and sustainable management of water and sanitation for all; Ensure access to affordable, reliable, sustainable and modern energy for all; Promote sustained, inclusive and sustainable economic growth; Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation; Reduce inequality within and among countries; Make cities and human settlements inclusive, safe, resilient and sustainable; Ensure sustainable consumption and production patterns.)

Poverty or hunger depend on economic growth which can be boosted by ICT, education can be spread using internet, or the sustainable management of water can be ensured by using advanced monitoring technologies.

Mohammad Mozammel Haque and Abd. Rahman Ahlan suggest that “there must be a push for better data to allow progress to be tracked and leaders to be held accountable. Data are most important for business prosperity. Wrong data can help make wrong policy” [3] and this can affect states, business communities or international organizations who want to act on the territory of a developing state.

ICT had a very important role in shaping our society by reducing distance through fast communication and data transfer, by offering wide and spread access to knowledge or by redefining accountability through monitoring policies implementation.

All of those factors are related to economic growth by utilizing big data. A good example where knowledge can make the difference is on reproductive health. This “can contribute to women’s economic activities by better health and decrease the number of children. In that way, ICT increases their income-earning capability.” [3] “The world needs open knowledge repository where people can access to information quickly and very easily at the time of requirement. Because ICT has the problem-solving capability and it enhances overall productivity for socioeconomic development” [3]. As an example, we can consider the precise calculation of the GDP or the economic surveillance which rise the trust in a specific economy and encourage capital to ‘flow in’ from the global market.

The financial service industry is also totally dependent on innovation in ICT in order to survive by improving efficiency and performance. Because the digital transformation of our society and the new technologies changed the way of doing business, the banking system has become much easier to use and much more reliable. “It was inevitable that technology would meet finance and spawn fintech.

The use of technologies like algorithmic machine learning, collecting massive amounts of data and interpreting them for decision-making or ‘crystal-ball’ predictions (predictive analytics), as well as distributed ledgers (blockchain), will give rise in financial industry to innovative business models with increased levels of efficiency, productivity, cost-effectiveness while also improving on customer-centricity.” [4]

Consequently, financial services are the most relevant sector for the rise of Blockchain technology.

3. What is Blockchain as part of ICT4D

In this chapter I will show the main features of Blockchain technology and try to see if this technology could be understood as part of the ICT4D. Following this general definition, “a blockchain is a data structure that makes it possible to create a digital ledger of data and share it among a network of independent parties” [5]. **In simple terms, this new technology can do the job of a bank: it can keep an electronic secured ledger of all transactions made by users.**

(The most relevant example of how Blockchain technology is used, as well as the way Blockchain technology has gained notoriety, is Bitcoin.) It could be the moment when Information Technology, or IT, can turn from a medium of communication and facilitation of everyday activities into a source of ‘trust’.

The trust is achieved by the way blockchain is working. Here, “nobody’s going to tamper with records on the Blockchain without sending up red flags that would be very quickly noticed by alert Blockchain developers” [6]. Any attempt to modify records in the Blockchain will fail because copies of the recorded data are stored in many other servers called nodes.

Those nodes are important because “a blockchain is a peer-to-peer system with no central authority managing data flow. One of the key ways to removing central control while maintaining data integrity is to have a large distributed network of independent users. This means that the computers that make up the network are in more than one location. These computers are often referred to as full nodes.” [5, p. 8] Thus, these nodes function as servers that constantly update and store the information registered in the blockchain.

Furthermore, they are interconnected, and they are constantly transmitting information about the validity of the block records. “If a node malfunctions, the IT staff can work with a Blockchain expert to isolate the server and troubleshoot that node to determine what went wrong. [...] It may transmit records that make no sense to other nodes. It may refuse to transmit any sort of data at all. It might ‘go rogue’, create its own version of the Blockchain and create records that the other nodes cannot use in any meaningful way.” [5, p. 10]

But, in order to avoid any attempt to modify the data from all the nodes in the same time, this technology uses two encryption methods called hash and timestamp. Hashes are extremely complex mathematical problems that require significant computing power to be resolved, and timestamps are a digital method to mark in time the production of a particular event (in the present case the building of a block of information). **“This makes it possible for Blockchain experts to inspect records on the Blockchain to determine the facts of any given transaction or to detect attempts to tamper with the ledger.”** [5]

To conclude, Blockchain is a database, but not a regular database. It is a database that you can trust in, because it is decentralised and literally no one can control it. Meanwhile, Blockchain is consuming a lot of resources during the encryption process. **Except Bitcoin, the most famous Blockchain project, there are many other coins based on this technology that can provide useful tools for developing countries.** On Ethereum for example, there are such things that should be mentioned: decentralised applications (DApp), decentralised autonomous organisations (DAO) and smart contracts.

Decentralized applications (DApp) may be one of the most revolutionary aspects of Ethereum. They can manage decentralized autonomous organizations and digital assets through decentralized management. „This structure has a lot of appeal because many people believe that absolute power corrupts absolutely. For those who are fearful of losing control, this type of structure has massive implications.” [5, p. 54] “Our working definition of a Dapp is an application that runs on a network in a distributed fashion with participant information securely (and possibly pseudonymously) protected and operation execution decentralized across network nodes.” [7]

Decentralised autonomous organisations (DAO) represent different entities inside Ethereum. “A DAO is a more complex form of a decentralized application. To become an organization more formally, a Dapp might adopt more complicated functionality such as a constitution, which would outline its governance publicly on the blockchain, and a mechanism for financing its operations such as issuing equity in a crowdfunding.” [7, p. 24]

When such kind of an organization is created, its initiator may also invite other people to take part in the governance process. It is important to note that participants in a DAO blockchain can remain anonymous.

Smart contracts within Ethereum are similar to any contract in everyday life, except that there is no central authority to ensure compliance with that contract. Here, “the blockchain acts as conflict mediator, should a party fail to honour an agreement” [8]. Ethereum may require the application of a specific provision in a smart contract, because through Ethereum it can be proven that certain conditions have been fulfilled or not. According to Richard Caetano, in order to understand smart contracts, we should „imagine a group of participants who would like to conduct business together without revealing their identity and without involving a third-party of trust. They could agree on a particular contract that can include an objective set of data points, such as an expiration date or a strike price.” [9] This contract will be protected by the network through blockchain technology, with each party actively participating through vote.

Returning to the definition of Richard Heeks, Blockchain is a more complex ‘entity’ – because it is shared among computers from all around the world – and it can process or communicate digital data. Thus, if I will prove that it can also deliver some part of the international development agenda in a developing country, Blockchain is going to be entirely part of the ICT4D study field.

4. Blockchain in developing countries

In the previous chapter I argued that Blockchain is a new technology that can generate trust in electronic transactions or in online social organization. Excepting the part that it can produce added value by eliminating third parties in the financial transactions, Blockchain can also be used to reform state apparatuses wherever the state cannot provide a trust model.

Developing states could be the best laboratory for this technology. “In most places in Africa and India, for instance, state organizations are inefficient and poorly run, and record keeping is predominantly paper-based. Renewing a business license would likely require getting on a bus, going into town and standing in a queue for hours. And since computers are too costly in those areas, official documents are often typed by hand” . [A. Castor, Blockchain’s Greatest Impact Will Be in Developing Countries, Says UPenn Lecturer, 2018, <https://bitcoinmagazine.com/articles/blockchains-greatest-impact-will-be-developing-countries-says-upenn-lecturer/>, accessed 20.02.2019] Saving people time means more efficiency, and more efficiency means more productivity. This will generate economic growth. “Smart contracts (applications that run on the blockchain and control the transfer of digital assets between parties) could also provide value in areas where the legal system is too expensive, slow or untrustworthy. And establishing an identity on the blockchain would be a core part of giving people access to services”. [<https://bitcoinmagazine.com/articles/blockchains-greatest-impact-will-be-developing-countries-says-upenn-lecturer/>]

As opposed to paying notaries or spending days and hours to show someone that you own a piece of land by checking state written records, it is cheaper to record a transaction on Blockchain and it is easier to show a link to Blockchain. Besides keeping records on property, the state can provide other services based on this feature like citizenship or other forms of identity that are stored in a centralized database to securely preserve them [K. Choudhury, What Blockchain Means for Developing Countries, 2018, <https://medium.com/swlh/what-blockchain-means-for-developing-countries-1ec25a416a4b>, accessed 20.02.2019].

The most widespread use of Blockchain, as a currency, could have a significant impact on developing countries' economy. Cryptocurrencies, such as Bitcoin or Ethereum, proved in time to be safe and secured. **The lack of technology let people in many poor regions of the world out of banking infrastructure and consequently, out of capital to start new businesses.**

“The introduction of digital currencies will help dozens of developing nations catch up, allowing millions of inhabitants to access banking facilities that many of us take for granted.” [D. Lee, 5 ways blockchain is boosting developing countries, 2018, <https://medium.com/ommerdotcom/5-ways-blockchain-is-boosting-developing-countries-58b3299bd061>, accessed 20.02.2019] Don and Alex Tapscott come with a very interesting example. Nicaragua, one of the most beautiful states in Latin America, is also one of the poorest. Here we have 7 bank branches per 100,000 inhabitants while in the United States there are 34 branches per 100,000 inhabitants. Consequently, only 19% of the Nicaragua population have a bank account and this means a lack of financial products to start new businesses. But what is interesting is that 93% of them have a mobile phone, which reveals new possibilities to access cryptocurrencies and thus get the microcredit needed to develop a business [10].

As I already mentioned, keeping safe records is one of Blockchain's most valuable feature. Then, “tracking physical goods through the supply chain is one of the most touted applications of blockchain technology” [<https://medium.com/swlh/what-blockchain-means-for-developing-countries-1ec25a416a4b>]. **More and more companies are experimenting with this technology in order to ensure food safety throughout their supply chain.** Also, the simultaneously use of Smart contracts and DAO could have a great impact in the services industry by enabling services transaction to happen in a fast, secured and decentralised way. A developing country “can leapfrog counterparts in institutional development by automated legal procedures, customs payments, ownership transfers, business transactions and allowing widespread disintermediation across industries” [<https://medium.com/swlh/what-blockchain-means-for-developing-countries-1ec25a416a4b>].

At the same time, Blockchain could reshape even the borders of the humanitarian aid. Billions of dollars are transferred annually to developing countries and, as Don and Alex Tapscott state, an important part of that money was stolen by intermediary parts. Thus, “the blockchain can improve the delivery of foreign aid in two ways. First, by disintermediating the middlemen who act as conduits of large aid transfers, it can reduce the chronic problem of outright misappropriation and theft. Second, as an immutable ledger of the flow of funds, it compels large institutions, from aid groups to governments, to act with integrity and abide by their commitments.

If they don't, people will be able to see their malfeasance and hold them to account.” [10, p. 20] UNICEF initiated in 2015 a project based on cryptocurrency called ‘UniCoin’, which aimed to help poor children going to school. Thus, a child needing help “can ‘mine’ by submitting an inspirational drawing to the program. The coins are then exchanged for a notepad and pencil.” [10, p. 190] Also, there is another initiative of the World Food Programme, an organization who transfers money in a refugee camp from Azraq, Jordan, by using an iris recognition technology. “The amount of money is then passed on via a blockchain-based computing platform. The program is currently private and used only by the WFP, making it more of a database project than a real blockchain.” [The Express Tribune, Blockchain revolution comes to world of humanitarian aid, 2018, <https://tribune.com.pk/story/1638161/8-Blockchain-revolution-comes-world-humanitarian-aid/>, accessed 25.02.2019]

Some other concrete examples of Blockchain technology implemented in developing countries are as follows:

- **Venezuela** is going through an economic and political crisis nowadays, with a hyperinflation that causes prices to double in less than a month. Trying to face those hostile conditions, local people turned to cryptocurrencies. Now, “people from around the globe are helping the country find its way to cryptocurrency. For example, AirdropVenezuela is facilitating donations to tens of thousands of verified Venezuelans.” [P. Garg, Venezuela Could Set New Precedent for Bitcoin as a Medium of Exchange, 2019, <https://cryptoslate.com/venezuela-precedent-bitcoin/>, accessed 25.02.2019]. According to crypto statistics hub Coin Dance, the weekly trade volume for bitcoin rose from 157 in January 2018 to 2487 BTC in February 2019 [Coin Dance. Local Bitcoins Volume (Venezuela), <https://coin.dance/volume/localbitcoins/VES/BTC>, accessed 25.02.2019].
- **Russia:** after the poisoning of former Russian military officer, Sergei Skripal, this country faced massive sanctions from the US government. From that moment on Russia starts to rely on P2P exchanges due to the government crackdown and for substituting Dollar with Bitcoin [A. Dharshan, Developing World seeing record crypto numbers despite market slump, 2019, <https://cryptoticker.io/en/developing-crypto-p2p-s slump/>, accessed 25.02.2019]. “Vladislav Ginko, an economist at the Russian Presidential Academy of National Economy and Public Administration, a state-funded institution, said the government is taking steps to minimise the impact of US sanctions that have hit the Russian rouble by replacing some of its US dollar reserves with the world’s most popular cryptocurrency.” [<https://medium.com/swlh/what-blockchain-means-for-developing-countries-1ec25a416a4b>]
- **India:** in this country the Central Bank – the Reserve Bank of India (RBI) – banned cryptocurrencies. “The ban by the RBI meant that banks cannot provide services to cryptocurrency exchanges which meant a complete halt in trading in India and because of this P2P has flourished.” [H. Chowdhury, Russia plans to tackle US sanctions with Bitcoin investment, says Kremlin economist, 2019, <https://www.telegraph.co.uk/technology/2019/01/14/russia-plans-tackle-us-sanctions-bitcoin-investment-says-kremlin/>, accessed 25.02.2019].

5. Conclusions

In this paper I argued that ICT4D field is a highly important subject in designing development policies and that Blockchain is part of ICT4D study field due to its technical properties. Then, by analyzing some examples of concrete implementation of Blockchain technology in developing countries, I consider that Blockchain can deliver some part of the international development agenda through the following features:

- **Secured transactions:** improved access to banking facilities for the poor regions where there are no regular banking branches and a reliable currency for the cases where states central banks fail to ensure stability.
- **Generating a trustful working environment:** there is not only secured financial transaction that convinced people to use this technology, but also the possibility to create decentralized online organization where its members can democratically participate and to reform state bureaucracy by creating a secure recording system and by introducing an electronic management of identities, signatures and other formal bureaucratic papers that people deal with.
- **An added value for economy:** this technology can create new well paid jobs in developing countries facilitating an important capital flow for poor regions.

Considering those features, Blockchain is definitely having an important impact on the international development agenda and it also possesses a great potential to further improve economies from developing countries. Blockchain technology could play an important role in reducing the economic gap between poor and rich countries, but it needs proper policies and a progressive environment, eager to change itself.

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