

**International
Institute of
Social Studies**

Erasmus

**IN BLOCKCHAIN WE TRUST?
The Good, The Bad and The Ugly of Blockchain in
Humanitarian and Development Aid**

A Research Paper by:

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in partial fulfillment of the requirements for obtaining the degree of

MASTER OF ARTS IN DEVELOPMENT STUDIES

Major:

Governance and Development Policy (GDP)

Specialization:

Public Policy Management (PPM)

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The Hague, Netherlands

November 2019

Disclaimer

This document represents part of the author's study programme while at the Institute of Social Studies. The views stated therein are those of the author and not necessarily those of the Institute.

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Contents

List of Acronyms

List of Images

List of Tables

List of Annexes

Abstract

1. Introduction

1.1. Research Objectives and Questions

1.2. Methodology and Methods

1.2.1. Literature Review

1.2.2. Semi-Structured Interviews

Informants

Interviews Procedure

Results of the Interviews

1.3. Critical Reflection Regarding the Methodology

2. Setting Some Points Out on Blockchain

2.1.

3. Trust Me If You Can: Building Trust Through Blockchain

3.1. The Role of Trust in Development Aid

3.2. The Role of Trust on Blockchain

4. Blockchain on Development and Humanitarian Aid as Trust Enabler

4.1. Aid Fundraising and Aid Tracking

4.2. Digital Identity

4.2.1. Identity, Digital Identity and UNHCR Identity Meaning

4.2.2. Some Cases of Digital Identity and Biometrics in Humanitarian and Development Aid Contexts

4.2.3. Digital Identity + Biometrics + Blockchain = Trust?

4.3. Cash-Based Transfers

5. Should the Blockchain Stay or Should the Blockchain Go? Conclusions

Images

Tables

Annexes

References

List Acronyms

ATM – Automated Teller Machine
BCT – Blockchain Technology
DLT – Distributed Ledger Technology
DNA – Deoxyribonucleic Acid
FFP – Fund For Peace
GDPR – General Data Protection Regulation
ICT – Information and Communication Technology
ID - Identity
IDEA – Institute for Democracy and Electoral Assistance
IO – International Organization
MOOC – Massive Open Online Course
NGO – Non-Governmental Organization
OECD – Organization for Economic Cooperation and Development
RICCs – Refugee Inclusion Community Currencies
STOA – Scientific Foresight Unit
UN – United Nations
UNHCR – United Nations High Commissioner for Refugees (UN Refugees Agency)
UNICEF – United Nations Children’s Emergency Fund
UNOCHA – United Nations Office for the Coordination of Humanitarian Affairs
UNWomen – United Nations
VPN – Virtual Private Network
WFP – World Food Programme

List Images

Image 1. Graphic Visualization of a blockchain

Image 2. Distributed Ledger vs Centralized Ledger

Image 3. How consensus is built on blockchain

List of Tables

Table 1. Four main search strategies

Table 2. Search Results

Table 3. Sources example of literature review

Table 4. Distribution of informants by position and sector

List of Annexes

Annex 1. Semi-Structured Interview Guide

Annex 2. Comparison of different types of blockchain

Annex 3. Aid Disbursement Conventional Process

Annex 4. Aid Disbursement with Blockchain

Acknowledgements

Thanks to Diego, my husband, my support in everyday life and has become a wonderful cook since we came to The Hague. Thanks to my beloved daughters Camila and Valeria, the lights whose guiding me every single day of my life, they always give me the strength to fulfil all the achievements of my life. Thanks to my mother Luz Angela, who has been always by my side, supporting me in all my projects. I want to thank my supervisor Georgina Gómez for her help, her insightful comments and her constant encouraging me to do my best. Thanks to Rodrigo Mena for his orientation and useful advices in the elaboration of my ideas.

Thanks to all the ISS family, who always make us feel at home.

Abstract

Blockchain technology was created in 2008 at the same time as Bitcoin, but it was not until 2015 when computer scientist and entrepreneurs, started to develop blockchain as an independent tool from bitcoin. Since then, many industries have begun to use the new technology, including the development sector, as blockchain has the potential to increase the efficiency in the delivery of aid assistance.

This paper exposes the positive (good) and the negative (the bad) features of the blockchain, as well as its challenges (the ugly), using an exploratory methodology, based on case studies corresponding to diverse experiences involving humanitarian aid, to conclude analyzing its impacts on institutional and community trust on intervened communities. In the paper it is analyzed how blockchain can promote and build trust in fragile contexts, particularly to deliver aid, in a reliable way. In particular, the paper analyses if blockchain can be a trust enabler in critical activities, like aid fundraising, aid tracking, digital identity, and cash-based transfers. All these fields present a series of challenges that can be met by blockchain, especially in topics related to the effective delivery of the aid, to the specific individuals in a safe way, and avoiding the possible diversion of the aid, in the field.

Finally, the document portrays how blockchain can delineate new way to provide trust in the transactions of humanitarian aid. So, aspects of blockchain like decentralization, transparency, traceability, automation, accountability and immutability are analyzed in terms of their effect in the delivery of aid, to highlight the potentials of blockchain in the field of international cooperation as well as its risks and challenges.

Relevance to Development Studies

Blockchain can be a tool of main importance in the delivery of aid in extreme conditions. Consequently, it is very important that scholars research about the possibilities and threats that blockchain purports in the case of international cooperation. As virtual transactions of any kind become more common, even in remote or isolated areas, blockchain expands the possibilities to deliver aid, even in the event of extreme difficulties to access to the field. As a technological device, blockchain also purports a series of threats and concerns, especially in aspects related to security and confidentiality, therefore it is very important to develop a corpus of knowledge capable to depict a whole framework about the possibilities of blockchain, so that individuals and organizations can make informed decisions in this area.

Keywords

Humanitarian Crisis, Humanitarian and Development Aid, Innovation for Development, Blockchain, Trust in Fragile States, Shift in Trust with Blockchain, Building Trust with a Trustless System.

IN BLOCKCHAIN WE TRUST?

The Good, The Bad and The Ugly of Blockchain in Humanitarian Action and Development Aid

1. Introduction

International Organizations have had always concerns about how to deliver the aid effectively to their targeted recipients. Those concern have diverse causes that can goes from receiving funding from different donors to designing and developing aid programs with a deep study of particularities of the targeted community, planning proper logistics for each of those programs, getting the necessary infrastructure to execute them, to finally, deliver the aid in any of its modalities to the final beneficiaries and thus, achieve their project goals and objectives, sometimes despite the efforts invested, still aid programs not always reach the people whom is intended. (Zambrano et al., 2018)

Aid is delivered by a huge range of different organizations pursuing the bigger objectives of the assistance in fragile states. Their activities can go from promoting and collecting funds, coordinating the deliver aid logistics, registering their beneficiaries, keep the records of the transactions among other functions to achieve their final goals and be accountable for the donors; for so, the use of technology on their processes, have made easy executing those hectic tasks, making delivering aid more effective, plus, could reduce excessive bureaucratic bottlenecks, giving as well solutions to security issues in the field (Mena, 2018) as it has pointed by many organizations¹.

With the increasing developing innovations on technology, humanitarian and development aid have been gone through a big change since new computational sciences mixed up with artificial intelligence, big data and other solutions have enable to humanitarian providers bring aid in ways as it is not used before. Many of those providers on their web pages, have published their achievements through innovative software and technology solutions, specially blockchain. As an example of this, The International Federation of the Red Cross has a program across Kenya communities called Refugee Inclusion Community Currencies (RICCs)². Some of the agencies of UN are working on projects based on blockchain with biometrics as well, for instance, UNWomen³ and WFP⁴ which still are in pilot stage, are using blockchain based solutions to deliver aid to the Syrian refugees in Azraq and Zataari camps of UN. Lately, the first agency of UN to release a technological solution based on blockchain to receive, manage and distribute donations on ether and bitcoin as funding to be granted out in the same crurrency, is UNICEF⁵.

While this innovative technologies apparently bring new solutions, its usage also entails new challenges as the technology has to interact with the social and political realities where they are implemented and with the beneficiaries of the programs where

¹ <https://www.weforum.org/agenda/2018/01/4-ways-technology-can-play-a-critical-role-in-disaster-response/>
<https://www.unocha.org/es/story/future-technology-crisis-response>

<http://media.ifrc.org/innovation/solferino-academy/the-future-is-now/>

² <http://media.ifrc.org/innovation/wp-content/uploads/sites/9/2019/07/GIFT-Update-June-2019.pdf>

³ <https://www.unwomen.org/en/news/stories/2018/2/news-event-blockchain-technology-and-humanitarian-action>

⁴ <https://innovation.wfp.org/project/building-blocks>

⁵ <https://www.unicef.org/press-releases/unicef-launches-cryptocurrency-fund>

technology is use, to not increase the crisis situation of the population involved (Mena, 2018) and not increase the risks that the use of the information brings against of people, as Jacobsen pointed in the case of shared sensitive data of Syrian refugees (Jacobsen, 2015). Other cases presented on literature where projects encountered unintended consequences. Some examples of it are, the registration with iris recognition of refugees in Kenya, which was crosschecked with Kenya national biometrics data, collected on national elections, represented a new exposure risk of intrusion and insecurity to refugees. As an addition, technical problems of internet broke the program, causing delays and cancellations of food aid distribution among refugees (Sandvik et al, 2017).

On the effort to avoid collateral negative consequences to humanitarian and development interventions on scenarios full of uncertainties, and where trust on institutions and on peers have vanished, international community integrated by governments, international organizations and even some civil society organizations, have actively participated and adhered to some minimum agreements on how delivering aid should be properly done by mechanisms as Monterrey Consensus⁶, Doha Declaration⁷, Addis Ababa Action Agenda⁸ on financing for development, and by agreements such as Paris Declaration and Accra Agenda⁹ on aid effectiveness.

In this sense, humanitarian providers must frame their projects within the principles for humanitarian action, which must be the core guidance for aid providers to establish and maintain access to affected people, whether on natural disasters or conflict related emergencies. Those principles are: *Humanity*, which is protect life and health respecting human beings; *Neutrality*, on which humanitarian actors should not engage on political, racial, religious or ideological controversies; *Impartiality*, which is provide aid making no distinctions based on race, nationality, gender, religion, class or political opinions; *Independence*, referring to humanitarian action should be autonomous from political, economic, military and any other actor where projects are implemented; and finally, the principle on *No Harm*, which is no aggravate by actions or omissions the current state of the victim, preventing and mitigating the effects of negative impacts of interventions. Those principles were brought by the International Committee of the Red Cross proclaimed in Vienna in 1965 and were adopted by United Nations general Assembly on 1991 (UNOCHA, 2012) and currently most of the aid providers as NGOs are implementing those principles as standards.

Finally, in order to tone down the panacea level some media has given to blockchain in humanitarian, this paper aims at exploring the positive (good), the negative (the bad) characteristics of blockchain, as its challenges (the ugly) on the chosen cases applications analysed on Chapter 3, to conclude analysing their impacts on institutional and community trust on intervened communities.

⁶ https://docs.google.com/viewer?url=https%3A%2F%2Fwww.un.org%2Fen%2Fdevelopment%2Fdesa%2Fpopulation%2Fmigration%2Fgeneralassembly%2Fdocs%2Fglobalcompact%2FA_CONF.198_11.pdf&embedded=true&chrome=false&dov=1

⁷ https://docs.google.com/viewer?url=https%3A%2F%2Fwww.unodc.org%2Fdocuments%2Fcongress%2FDeclaration%2FV1504151_English.pdf&embedded=true&chrome=false&dov=1

⁸ https://docs.google.com/viewer?url=https%3A%2F%2Fwww.un.org%2Fesa%2Fffd%2Fwp-content%2Fuploads%2F2015%2F08%2FAAAA_Outcome.pdf&embedded=true&chrome=false&dov=1

⁹ <https://docs.google.com/viewer?url=https%3A%2F%2Fwww.oecd.org%2Fdac%2Feffectiveness%2F34428351.pdf&embedded=true&chrome=false&dov=1>

1.1. Research Objectives and Questions

In order to address adequately the use of the blockchain technology on fragile environments, this paper has the following objectives:

- Identify the different characteristics of blockchain technology.
- Identify the role of trust in development aid.
- Identify blockchain application on humanitarian and development contexts.
- Analyse how blockchain characteristics could contribute to build trust on humanitarian and development contexts.

In order to achieve the purposed objectives, this research will be guided by the main question as follows:

How blockchain technology characteristics can build trust on current problems of humanitarian and development aid?

In order to answer the main question, this research pursue the following established sub-questions:

Sub-Questions:

- How blockchain characteristics could affect positively trust on its different applied cases on humanitarian and development aid?
- How blockchain characteristics could affect negatively trust on its different applied cases on humanitarian and development aid?
- Which are the challenges blockchain brings on humanitarian and development contexts?

1.2. Methodology and Methods

In this chapter, the methodology, the methods and the research process will be discussed as well as the limitations that somehow influenced the study, including how my positionality had reflected the research process.

Blockchain technology was recently created in 2008 at the same time as Bitcoin through a white paper issues by Satoshi Nakamoto to create a digital cash payment system without intermediaries then transaction are conducted peer-to-peer and secured by cryptography; but it was until 2015 when computer scientist and entrepreneurs, started to explore and develop blockchain as a independent tool from bitcoin. Since then, blockchain has constructed a path by itself, many industries have bet to the new technology and development sector would not be the exception on bring this new technology to try to boost the efficiency delivering aid assistance. It is estimated blockchain would get its maturity until 2025, but still there is a long way to go for it.

As a new technological solution, there are now enough technical literature that helped me to understand the basics on blockchain, but regarding the use of blockchain in humanitarian sector there are some academic papers, some master thesis and finally, there are also, international organizations reports on how they are using blockchain on

their aid programs. Therefore, the initial reading revealed few knowledge and theories existing on literature regarding the research topic this paper intends to develop, but nevertheless it has interesting elements that worth to continue on the study to discover. thus, it was necessary to conduct an exploratory research which is defined by Stebbis (2001) as:

‘a broad-ranging, purposive, systematic, prearranged undertaking designed to maximize the discovery of generalizations leading to description and understanding of an area of social or psychological life. Such exploration is, depending on the standpoint taken, a distinctive way of conducting science – a scientific process- a special methodological approach (as contrasted with confirmation), and a pervasive personal orientation of the explorer. The emergent generalizations are many and varied; they include the descriptive facts, folk concepts, cultural artefacts, structural arrangements, social processes; and beliefs and beliefs systems normally found there.’

Thus, as part of the exploratory study and in order to acquire more technical knowledge on blockchain, I signed up in a ‘Introduction to Digital Currencies’ Massive Open Online Course conducted by University of Nicosia¹⁰, in which provides understanding of blockchain technology as part of the syllabus and I found out every Friday on The Hague Tech organization, there is an open space where various experts on blockchain that are signed up on MOOC, meet up to discuss about the week topic, following the course material, clarifying doubts and building knowledge about it, so I also decided to attend those meetings to get insights from knowledgeable people on the topic. Applying to the online course and meet with blockchain experts, allowed me first, to gain some technical knowledge about blockchain, so I could have critical opinions about the topic and second, it made me distinguished the blockchain hype on some readings.

The exploratory study was also inductive, meaning by this, it was necessary to get insights from collected data, in order to build a framework on which the research could rely on and then, proceed to some conclusions related to the research questions, due to there are not yet theories related with the topic. This inductive research started and guided by the research questions described in 1.1. chapter.

Regarding the research questions, they were defined throughout the reading process, which begun with indistinctive reading around three main topics, blockchain, humanitarian and development aid and trust. On blockchain topic, the reading was conducted regarding other applications of blockchain associated with development, first starting with the white paper in which blockchain came to life with bitcoin as a payment cash system, other readings using blockchain in health systems and commercial supply chains. Regarding humanitarian and development aid, there are rich literature issue by scholars, about deficiencies of the aid system, how aid is delivered on conflicted and fragile contexts, and readings about the use of technology on the sector was useful as well. And finally, I found readings related to the aid system and technology contributes to re-

¹⁰ https://www.unic.ac.cy/blockchain/free-mooc/?utm_source=Google&utm_medium=Search&utm_campaign=Mooc-Digital-Currency-Europe&utm_term=%2Bmooc%20%2Bdigital%20%2Bcurrency&gclid=Cj0KCOiA5dPuBRcARLsAJL7oeiMTbKLPXGCgiwo84Z6l_E2bN2Ti2poDKIPdHLGS0mCz5WiCdD7X5gaAlDEEALw_wcB

construct trust in untrusted conflicted areas. All those readings had a key important dynamic to contribute to the research topic to get insights of the phenomena, but still it was necessary to develop a literature review as a base framework of reference to the research.

1.2.1. Literature Review

Conducting a literature review was helpful to understand the existing knowledge was already related to the topic (Rowley and Slack, 2004) and the relation of technology and its implementation on the aid system, in order to create an initial stage of the finding relevant literature, applying Rowley and Slack (2004) four strategies shown in Table 1.

Searches were conducted on Google Scholar and Erasmus University of Rotterdam Repository typing ‘blockchain technology’, ‘Blockchain and humanitarian aid’, ‘Blockchain and trust’, using as filter results since 2018, which results are shown in Table 2.

In order to find relevant sources of information, it was necessary to apply the citation pearl growing strategy to develop more branches of information for the third strategy, using synonyms of the related words on this strategy shown in Table 3.

Articles were searching following those four strategies shown on Table 1, preferring those complying with follow criteria:

- Were relevant for the research
- Be up-to-date
- Hold extensive source referencing
- Written by an authoritative author

When searches generated many results, they were chosen by screening the abstract. Also was screened cited articles or reports from most relevant articles, in order to find more literature relevant for the topic as a variation of the citation growing approach proposed by Rowley and Slack.

As the final stage of the search strategy, Table 3 shows three examples of the relevant sources for the literature review.

Table 3. Sources example of literature review

| Author (s) | Year | Title | Source |
|-----------------------------|------|---|--|
| Bessant | 2015 | Case Study: Cash Based Programming (CBP) in the Food Assistance Sector | Centre for Research in Innovation Management (CENTRIM) |
| Zwitter and Boisse-Despiaux | 2018 | Blockchain for humanitarian action and development aid | Journal of International Humanitarian Action |
| Coppi and Fast | 2019 | Blockchain and distributed ledger technologies in the humanitarian sector | Overseas Development Institute |

Once the sources were selected, the literature review could be constructed which turn into the theoretical framework, to give validity of the present analysis in which blockchain technology is applicable.

1.2.2. Semi-Structured Interviews

Due to the limited literature related to the chose research topic, with the objective to supplement the deconstructed theoretical framework and to contribute to answering the research questions, it was decided to conduct 6 interviews to get a comprehensive study of the topic with different blockchain experts from various sectors of the economy and different countries, to reflect the opportunities and the challenges blockchain brings to aid assistance sector. According to Newcomer et al. (2015), semi-structures interviews are perfectly suited for situations where researches “are examining uncharted territory with unknown but potential momentous issues and you interviewers need maximum latitude to spot useful leads and pursue them.”

Informants

As this paper analyses blockchain technology, the aim was to acquire the most knowledge on blockchain as possible not only by myself or reading it on literature, so as the interviews gives a better glimpse of the topic, the interviews were selected by their expertise on ICT, specifically in blockchain technology. Some of them had already experience on humanitarian sector, which nourish even more the present study. The goal was interviewing 13 people that were related to blockchain technology and/or humanitarian and/or development sector. They were contacted, but only 7 of them agreed to take part of the study. By time to deliver the paper constrains, it would not possible to find more people that comply with the study criteria. Four of the eleven contacted informants could not share their knowledge due to the confidential agreements constrains they had signed with their companies, one just never responded to the request to be part of the study and one more felt he did not have enough knowledge on the specific topic. Four of the seven informants were met at the meeting in The Hague Tech following the University of Nicosia course in cryptocurrencies and blockchain, two of them were contacted through colleagues and one was known from undergraduate back in Colombia. Informant’s distribution across sectors are shown in Table 4.

Interviews Procedure

Having in mind the different background and experience of the informants, it was decided to carry out semi-structured qualitative interviews. The semi-structures interviews give the researcher the opportunity to adapt the questions taking into consideration the background of the interviewee and at the same time, the interviewee can share in greater way the topics they are knowledgeable on. (Brinkmann & Kvale, 2015)

With the objective to ensure consistency among the different interviews, before to conduct the first interview, a questionnaire guide was constructed, in order they allow to get to the answers of the research questions, so they were made based on them in a broader way. During the interviewing process, it was found not necessary for interviewees to answer all guide questions, but those question they already have experience about. Interviews lasted around 50-60 minutes as suggested by Newcomer et al. (2015) in order to decrease any possibility of fatigue to avoid any fatigue sign for the respondent and the interviewer.

The guide of the semi-structured interviews could be seen in Annex 2. Questions are Open-ended questions, which allows the informants to make suggestions and it gave the possibility the blockchain experts to set the base of the framework where my paper is analysed, making the present exploratory study sounder.

Of the total seven interviews, two of them were conducted over WhatsApp audio, due to those people were one in Colombia and the other in United States. The other five interviews were personally in The Netherlands, on the place the interviewee preferred. On conversations previous to the interviews, it was asked to the informants if they were agreed if the session could be recorded, all of them were agree, and the recordings are part of this paper personal archive. Also, every informant was asked if they wanted to keep their identity anonymous, just one of the informants asked to keep under confidentiality, but it was author's decision to keep al them anonymous in order to protect their personal data. Interview guide was use as parameter, but informants were free to express and tell their opinions and experiences, but having in mind to retake the conversation in case it goes out of the focus, trying to get the principal characteristics of the tool, as the advantages, disadvantages or challenges of it for the humanitarian and development sector.

Results of the Interviews

As every interview was recorded, once they all were done, they were literally transcribed and saved on seven Word Office documents, each per informant. The result data of the interviews was coded into these categories:

- a) Decentralization (no middle-man)
- b) Transparency
- c) Traceability
- d) Automation
- e) Accountability
- f) Immutability
- g) Trust

Those characteristics of blockchain are going to be the base to analysed on each of the blockchain applications on aid assistance, to determine if it is an opportunity, a disadvantage or is a challenge and in this sense, conclude if it is an enabler tool to build trust on fragile contexts. This analysis is going to be develop on Chapter 4.

1.3. Critical Reflection regarding the Methodology

As blockchain applications on humanitarian and development sector is still on its infancy, it was not possible to find much evaluations regarding its implications. The first encountered limitation is the limited literature regarding the topic, constricting this way the data collected and the conclusions as well. Some part of the literature comes from international organizations reports, which could be bias and ultra-optimistic, without showing the real threatens implementing blockchain to their aid processes and practices could have. So, as author, in order to avoid biases, applying myself for a course to acquire knowledge about the technology in study and interviewing experts in blockchain, makes me have my own opinion regarding organizations reports and media news.

As the way the informant of interviews were not by networking as technique, personally do not think they are bias under the presumption that people tend to recommend other

people with similar thinking or opinions, most of the informants were meeting in a neutral space where everybody were already knowledgeable on blockchain, with strong background on it and just by the hype.

Potential interviewees that were constrain by confidential agreements because their work, are head directors of the ICT company and are directly developing blockchain for WFP, which is understandable, but it is also a limitation to researches have access on first-hand of the crucial processes and information to the study.

Finally, it was not considered to conduct any quantitative formats such as surveys or questionnaires, since the nature of responses required for the research questions are more qualitative kind (Brinkmann & Kvale, 2015).

2. Setting Some Points Out on Blockchain

With the increasing development of the technology and electronic solutions to provide aid, before we get into the results of this research, it is necessary to get to know in a technical but basic way what blockchain technology is, how it works, what is making it a securer technology than what we have now, and finally, the principal characteristics of this technology are highlighted, in order to get the foundations of what this paper is discussing about.

When talking about blockchain, most of the people immediately relate it to Bitcoin and uses indiscriminately one concept or other, and maybe the cause of this confusion, relies on the fact Blockchain was created to support the Bitcoin currency transactions and both were release at the same time by Satoshi Nakamoto through a paper called 'Bitcoin: A peer-to-peer electronic cash system' in 2008¹¹. However, cryptocurrencies and blockchain are not the same thing. While Bitcoin is a cryptocurrency that could be traded between parties and has a market value, Blockchain is the technology that supports the cryptocurrencies and what makes cryptocurrencies a reality, so these cannot exist without Blockchain, but Blockchain can perfectly work without cryptocurrencies. (European Parliament, 2018)

Among literature, Blockchain has various definitions regarding how it is approached (Källner, 2019), as it is origins, as its possible applications, as its impacts; but for this chapter purposes, it will be considered from a technical perspective. Thus, Blockchain can be defined as a “decentralized database (ledger) that stores a registry of assets and transactions across a peer-to peer computer network acting as a public registry of ownership and transactions, which is secured through cryptography, and over time, its history gets locked in blocks of data that are then cryptographically linked together and secured. This creates an immutable unforgeable record of all transactions across the network. This record is replied on every computer that uses the network.” (Warburg, B. as cited in Radanović and Likić, 2018 p.584).

From the abovementioned meaning of blockchain technology, the following characteristics stand out:

- ***Blockchain is a decentralized database ledger:***

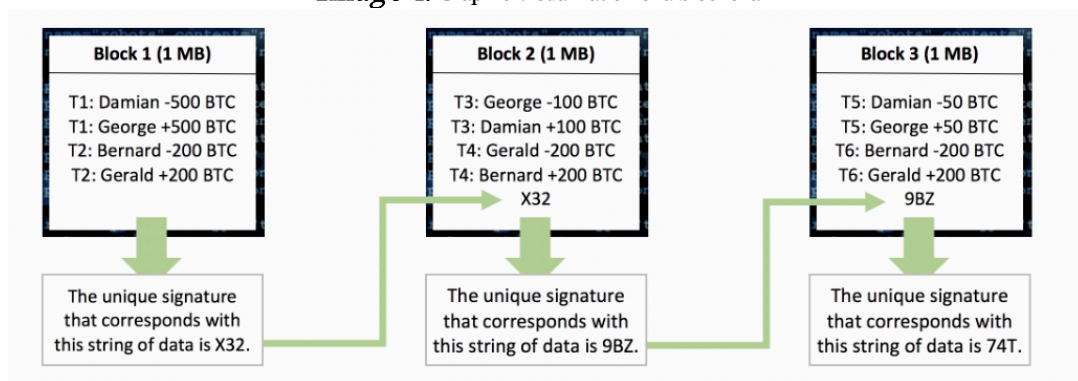
In traditional centralized systems, there is central authority trusted by all parties -bank, government or company – managing the transactions, the records and verifying them at any given time, controlling the access to that information on the ledger, allow it having the total control over the information, on which users have not fully visibility. Blockchain offer the same record keeping functionality but without a centralized architecture. (Boucher, 2017)

¹¹ Satoshi Nakamoto paper could be found at: <https://bitcoin.org/bitcoin.pdf>

- *Stores a Registry of assets and transactions across a peer-to-peer computer network acting as a public registry of ownership and transactions (Distributed):*

Computer participants in the network are called nodes, they are not located simultaneously at the same place, they are spread all over the world, working together validating transactions or data of a block, adding information to the blocks through consensus mechanisms and cryptography, using hash pointers to refer to the previous block unless it is a genesis block (Bashir, 2017). This hash is used to increased security to the block and also to link them together, having as a result a chain as the following image shows:

Image 1. Graphic Visualization of a blockchain



Source: Good Audience, 2018

- *Secured through cryptography, and over time, its history gets locked in blocks of data that are cartographically linked together and secured:*

Regarding cryptography, nowadays technology developers have created diverse consensus mechanisms to validate transactions through blockchain, but those are not relevant for the purposes of the present research. Thus, the two most important validation mechanisms are Proof of Work (PoW) and Proof of Stake (PoS). On the first one, miners which are the participants compete between them to find the encryption code to be added to the next transaction (Nakamoto, 2008), while in the latter, depending on how much coins holds the miners, before accepted by the network. (Vasin, 2014)

- *Creates an immutable unforgeable record of transactions across the network. This record is replied to every computer that uses the network:*

Immutability refers that data stored in the block cannot be altered or removed once it is entered, this specific characteristic of blockchain, provides transparency and accountability to the system.

As Blockchain is a structured data network, where information is share among independent parties and even though, the first blockchain came out into life as public,

technology companies have commodifying this technology, creating private and permissioned blockchains (Edwards, 2019). In that sense, currently there are different types of blockchain that allows or restrains nodes participation in the network, but for the purposes of this paper, only will be brought the public, private and permissioned blockchains.

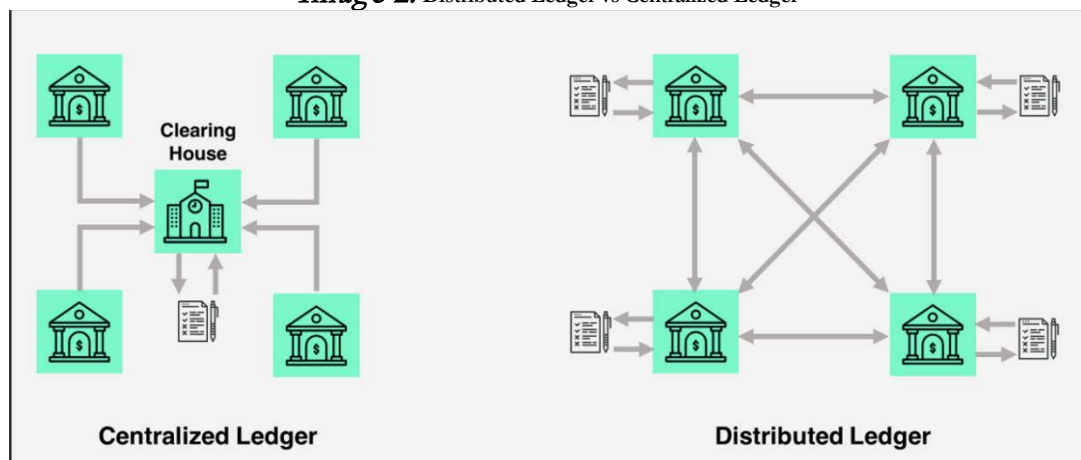
On public blockchains, there is a large and huge network where cryptocurrencies are the only data that can be traded between the parties, it has open participation at any level, and they have open code to access, which means first, no body owned the ledgers, second, anyone can join the network and see the transactions and third, the networks ensures compliance, transparency and security. (Edwards, 2019)

Additionally, private blockchains as its name suggests, are closely controlled membership between trusted participants to share confidential information without using any kind of token or cryptocurrency. This networks tent to be more centralized, which have led to some blockchain purist to state this type of blockchain goes against the fundamental purpose of the blockchain essence, that is being public and decentralized (Edwards, 2019).

Finally, there is the permissioned blockchain that controls the roles of the known and trusted nodes in the network, where they do not used distributed consensus mechanisms but agreement protocols in order to keep the records on the blocks. Permissioned blockchain could be private and public always with regulated access control. (Bashir, 2017)

Some people confuse private blockchains with distributed ledger technology (DLT). DLT is basically a database stored in various locations or among multiple participants, this means, is decentralized as well to eliminate the presence of a central authority or intermediary to process, validate and authenticate transactions, thus the records of transactions are stored in the ledger when there is consensus among the different involved parties and no needs to be chained as blockchain (Belin, n.d.) and could be seeing like the following image:

Image 2. Distributed Ledger vs Centralized Ledger

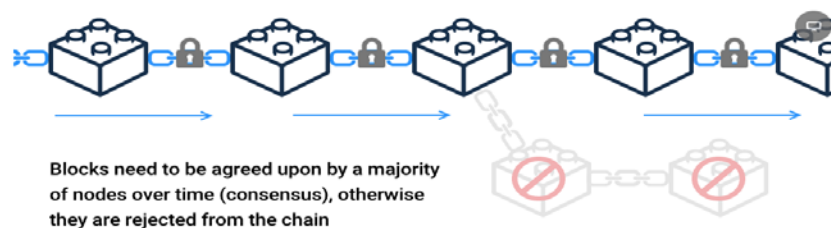


Source: Tradeix

Why is Blockchain catalogued as a disruptive and securest technology according to literature? According to....As blockchain creates consensus and honesty between

participant nodes and there is no need a central authority or a third party to enforce the rules, the enforcement comes from the validation given by the nodes to the transactions, this validation is represented with the algorithm and sometimes, depending on the blockchain, the validator receives an incentive as happens in public blockchain when trading cryptocurrencies. If a node tries to cheat the network recording information that does not match with the information contained in the other nodes, the cheater will be automatically ignore from the other participants. This is how the consensus is built among the network, as a fundamental characteristic of the blockchain and what gives security to this technology (Edwards, 2019). Then, to attack the system, requires attack every copy of the ledger simultaneously (Boucher, 217) that is spread all over the world.

Image 3. How consensus is built on blockchain



Source: Finder

Blockchain literature have identify some of the advantages and limitations of blockchain on its applications (references! For example, see). Starting listing some of the benefits: The first one is **Decentralization** as blockchain does not need a third party to validate the transactions and instead is made by consensus as a mechanism of agreement to validate; **Transparency and Trust** as other benefit, as the information contained in the block could be seen by anyone, allowing transparency to the system and building a trusted environment among it; **Immutability** because once the information is written in the blockchain, results difficult to change it; **Traceability** since the information is stored on each node of the network to maintain a copy of the transactions, they could be traceable with the internet protocol address number of the nodes, completing characteristics of transparency and immutability; **High Availability** due to the fact the system is made up of a lot nodes network, the information will be available on all of them, even if one of the nodes become inaccessible or if it leaves the system; **Highly Secure** since the blockchain uses cryptography to secure the transactions; **Process Simplification** as it stores information in order maintaining updated the database in a shared ledger among interested parties, reducing human cost, technological cost in organizing data processes; **Fastness** this characteristics applies mostly for blockchain in financial industry where transactions goes through a long process verification and data should be available and share between financial institutions involved in a transaction; **Cost Saving** because third parties and intermediates are eliminated with the blockchain process and their respectively costs (Bashir, 2017).

Regarding the limitations and even criticizes experts have state about blockchain, some of them are: **Environmental Cost** in order to provide security to the network through complex cryptographic algorithms means it requires a lot of computer power and consequently it has a high cost, even more those blockchain that runs cryptocurrencies on them; **Lack of regulation**, this issue facilitates scams, market manipulation and other activities such of Ponzi's schemes (Bashir, 2017); **Lack of Total Privacy** as transactions are not linked to identified people but are linked to internet protocol addresses, which means transactions will always linked and exposed to it (Bradley, 2019); and finally

more than limitations or a critique, even more financial sector had made big efforts to adopt blockchain on their operation systems, they do see blockchain as a threaten, basically because they have earning huge profits for playing the role of the middleman as money intermediary (Marr, 2018).

3. Trust Me If You Can: Building Trust Through Blockchain

In order to understand why innovations on technology became important on economic development, it is important to comprehend the current humanitarian and development panorama and how trust plays a key role on it. For so, is necessary to understand the trust issues in places where aid is delivered, called by the literature as fragile states or failed states, how aid providers such as IO and NGO's, could help to re construct trust on hostile situations and conflicted areas and finally, how technological innovations as blockchain, could facilitate those processes.

3.1. The Role of Trust in Development Aid

Trust and conflict are closely related to each other. Individuals that trust each other can more easily overcome a conflict situation than those who do not trust each other. When destructive conflict arise, trust is losing between parties and then they stop to commit on their proposed actions, increasing distrust among people, hindering conflict resolution (Lewicki and Tomlinson, 2014). Reinforcing this idea, Honeyman, Goh and Kelly (2004) argue that distrust is a great obstacle between two most polarized conflict groups, leading to a deterioration of moral standards, damaging cooperation and trust, where societies do not find a firm ground in which could be reconstructed.

The term of trust gets importance on any kind of interaction among individuals, that is why its definition has been given and framed by different social sciences branches such as psychology, sociology, economics, history and many others, but it is recently until those perspectives have integrated to recognize, trust plays an important role in social processes, such as cooperation, coordination and performance (Kramer and Tyler, 1996; Sitkin, Rosseau, Burt and Camerer, 1998 as cited on Lewicki and Tomlinson, 2014).

Trust is also recognized as a requirement for any social species to survive (Valentini and Kruckeberg, 2011), allowing the individuals of a community, to satisfy their needs through interactions with its peers and the surrounded environment (Krabbe, 2015), included governmental and non-governmental institutions. In order to achieve collective action, there has to be a minimum level of trust in each other and then, in our broader environment, trust level can be maintained (Lewis and Weigert, 2012)

In order to define trust, Ross and LaCroix (1996) add the components of risk and vulnerability and in this sense, trust is defined as “one party's willingness to risk, increasing his or her vulnerability to another (...) whose behaviour is beyond one's control” (p.315). Concepts of willingness and risk were also developed by Luhmann (cited by Kappmeier, 2012), who consider when an individual trust another, complexity is reduced and decreases the need of control the other's behaviour and decreases the levels of protective mechanisms in case the other violate that trust. Luhmann discussed the difference of personal trust and trust in the system, the first of them, is based on personal relationship experiences with the person, and the second of them, is develop by historical interaction patterns, shaped by a strong belief.

Literature shows the importance of the role of trust in economic development, here some examples. Adhikari et al. (2019), in their article, argue that maintaining trust relationships among aid delivery stakeholders is vital for financial programs management

and boost the effectiveness of the projects. Their field research was based in Malawi, having the objective to analyse why despite the great efforts of the donors and international organizations to support the health system in Malawi, some misused of funds and programme duplication happened, situation that led to a waste of resources due to the ineffective coordination and lack of trust among stakeholders.

Some researches shows strong evidence that fostering initiatives arranged by local actors and communities, engaging people in collaborative actions with each other's, in order to reconstruct local production with the actions of critical agents whom exercise control and hierarchy, act as a bridge between local and global levels of the economy (Gomez, 2016). Trust in these cases, is the key factor for the development of cooperation and coordination of the different actors' relationships, linking this way the local politics within state agencies (Vellema, 2016). One of the conclusions of this researches, is collaboratives and coordinated community, increases trust among individuals, and the cost of particular transactions get lower than the market, even when the state keeps controlling them through its mechanisms (Adler, 2001), which is a positive remark when untrusted governments institutions is about.

In economic sphere, individuals usually trade among them based on the trusted they have maintained through a dense web of social relationships, but when trades go beyond the boundaries of that network, individuals have to rely their trust in a third party to create trust (Pisa and Juden, 2017; Krabe, 2015), knowing this as institutionalized trust (Bachman, 2001; Covey 2006, Wollebaek, Lundasen et al, 2012 ac cited on Krabble, 2015: 64). That intermediate, would dictate the rules and instructions on which the transactions have to be made through their platforms, will keep the record of the exchange, identify the transaction parties and for doing so, reducing the risk and the uncertainties of parties of no trust each other, getting benefit of an exchange rate (North, 1991). Ledgers of importance in modern society are administrated by a third centralized party, few examples of it are: bank accounts, identity registration, land registries, security records, medical records, citizen records, academic certificates, accounting ledgers among others.¹²

Nevertheless, literature points out some reasons why people are not trusting anymore in third parties that provide that functions. The main of them are: the elevated average of transaction fee; the inefficiency on processing international remittances, which requires a lot of intermediaries and take as average between 3 to 5 days to be completed; third parties represent a single point of failure, entailing cybersecurity risks (Pisa and Juden, 2017); also, they are running the risk to be bribed, files and transactions records could be lost or stolen, and so much more.

3.2. The Role of Trust on Blockchain

With implementation of technological innovations on economic development projects, blockchain was not going to be the exception to have a space on the sector, where some aid providers were tempted by the hype to explore technological solutions on humanitarian and development projects.

¹² Nicosia University, 2019. MSc in Digital Currency. DFIN-511: Introduction to Digital Currencies. Session Week 2: The Byzantine General's Problem: 16-22 September 2019.

As it was largely described on the chapter called 'Blockchain Basis' of this paper, blockchain is an immutable data base, where all its transactions are recorded in all nodes distributed all over the world, without having the possibility to be erased from the block they are attached to, creating an available, verifiable and permanent digital history. Blockchain has been called a 'trust machine' given by it removes the trust that has to be relied on intermediaries in regular economic transactions (Van den Berg, 2018). As blockchain counts with trust mechanisms among the nodes, therefore it is not necessary a central party to validate or authorize the transactions broadcasted in the network. This fact reduces the power and legitimacy of middleman institutions and the returns gain on the intermediary service, so the ledger is maintained by the community instead by a single organization (Seidel, 2018).

Among literature regarding the topic, bitcoin blockchain is called a 'Trustless Machine', a concept that could not be more wrong, since it would be useless if it were not trusted (Werbach, 2018); even though, when cited quote of Satoshi Nakamoto refers to a trustless electronic transaction system should be alluding that it does not require trust in third parties to create value, however it is the willingness of people to trust on the operation of the system and digital ledgers are as real as money (2018). Trust in blockchain could be seen in a cooperative way, without the necessity of relying on trust on frequently face-to-face relationships transactions neither in a third party or authority, bringing together communities that otherwise do not trust each other sufficiently (2018).

Usually these tasks for financial transactions are done by banks, but with blockchain technology, there is not necessary that middleman because nodes are distributed all over the world, transactions could be done peer-to-peer, information on the blocks is immutable and secured by cryptography, characteristics that make participants trust the data held on a blockchain without having to trust each other or know each other (Pisa and Junden, 2017). Distributed trust is transforming the boundaries of legitimacy and power of what we currently know as trust (Seidel, 2018).

4. Blockchain on Humanitarian and Development Aid as A Trust Enabler

In economic development sector, aid providers, mostly international organizations, have been using blockchain in applications where its characteristics improves to automatize processes, keep records of money movements in ledgers and boost the rapidness on aid response. As this paper is focused on the use of blockchain on humanitarian and development activity, the discussion and analysis of the results of the conducted interviews crossed with pertinent literature, is going to be limited to fundraising and tracking Aid, digital identity and finally, the cash-based transfers, which are the main activities blockchain has been implemented so far within the sector.

Before starting the respective analysis, is significant to note the differences between public and private blockchain, since some of the characteristics change from one environment to other¹³. The first one, is an open ledger where everybody can participate without permission of a central party, it relies in open source software where anyone can join the network and once the node is update, is in the same level to validate transactions as any other node of the network, in other words, it has the same rights and responsibilities (Allende, 2018). The fact that anyone can join the network and see what is happening in there, makes the network publicly auditable, which enhances transparency but minimizes privacy (Finck, 2019). Bitcoin and Ethereum are the only current public blockchains and they have general-purpose infrastructure.

In the case of the private blockchains, they run in a network like intranet or VPN, the administrator has to grant access to actors interested to join and participate as node in the network, this type of blockchain are designed for a specific purposes and there is a party that plays as gatekeeper role. In this kind of blockchains, identity of participants is known, at least to the party that allows the access to it (2019). The participants in a private blockchain do not have rights as nodes in public blockchain, their access is limited on how much is decided to show them. (Allende, 2018). Private blockchains does not have associated cryptocurrencies on them and this is the cause the block mining activity with rewards as in public blockchains are inexistent, although they still need the hash to secure the blocks, task usually performed by the organization that owns the network (2018).

The difference between the public and private blockchains, is made due to most of the applications for development aid, are based on private blockchains, which is also going to be analysed along with the positive characteristics, the negative characteristics and challenges that the blockchain has on each of aid applications, to finally be able to conclude if it is a tool that can generate trust in the activity of development aid.

As follows, the three most used applications of blockchain on development aid:

¹³ To see the different types of blockchain, refer to Annex 2

4.1. Fundraising and Tracking Aid

To just give a current panorama of the humanitarian crises, according to United Nations Office for the Coordination of Humanitarian Affairs – UNOCHA (2018), it has been triggered mainly by these identified five factors: Conflict, from 2104 to 2017 displaced people arose from 59.5 million to 68.5 million; Natural disasters, caused by climate change the economic cost arise to billions of dollars and 350 million people affected by it; Food Insecurity, between 2015 to 2017 the number of people affected went up from 80 million to 120 million. Additional to these factors, UNOCHA have concluded that the current humanitarian crisis has extended, and the assistance has been directed to assist countries with profound political, social and economic issues as Somalia, South Sudan, Sudan and Syria. Finally, despite the increased funding by governments, humanitarian organizations and private sector, for 2019 the unmet needs will still remain high, since it is estimated that 132 million people in 42 countries around the world, will be in crisis and risk situations.

But problems in the humanitarian and development aid is not the only triggered cause, it is also by the architecture and lack of infrastructure to provide the assistance to the most needed. But it is not an easy task, nowadays, there are dozens of bilateral and multilateral organizations and hundreds of NGOs active in the industry (Knack & Rahman, 2007:177) receiving donations from different sources governments, private sector and others and the real challenge is how to establish a flow system and how to sort them properly as donations not always are timely, usefully or properly (Argollo Da Costa, Gouvêa Campos & de Mello Bandeira, 2012: 600) on one side, and how to allocate it properly and effectively, on the other.

As it if was not enough with the whole situation, there is lack of coordination along the aid supply chain and among all involved actors, this situation is leading to have misallocation of resources or duplication on money allocation as the case analysed by Adhikari et al. (2019) in Malawi, already mentioned on this paper before. Adding up to the causes, there are also enlisted corruption and fraud cases, since large amounts of money destined to aid, flows through unmonitored channels, facing difficult situations and contexts to get the right destination as chaos, conflicts or natural disasters, making even harder to track where aid money goes (Transparency International, 2010), making decline the accountability and transparency of aid agencies and undermining donors trust in local governments and NGO's and people's trust in aid institutions and system (Harvey, 2015).

All those facts have made people decline their trust on charities. As an example, NfpSynergy in association with an Australian consultancy called More Strategic (2019), conducted a quantitative research regarding levels, attitude to charities on society and other information related to it, with representative samples on Australia, Canada, Germany, Netherlands, Ireland, New Zealand, South Korea, United Kingdom and United States. Some of the key findings of the research are: trust in charities varies between country to country and over time, United States is the country with more level trust among the countries of the study, while Netherlands and South Korea have lower level; Ireland drooped drastically its levels of trust in charities although the believe on its importance and impact of charities is still high, for Ireland charity scandals have collapsed the trust and confidence of charity system; on its behalf, the Netherlands is one of the lowest levels of trust, people feel there are a lot of charities and fundraising.

Due to the necessity of improve quality management on development and humanitarian systems and also by shortage of donations, aid assistance institutions on one hand, looked forward to diversify the input funding resources, bringing to the fund scenario the private sector and individual donors by other mechanisms; and by the other hand, as tendency on society collaborations starts to blossom, this reinforced the demand for coordination and standardization of the different operation processes (Slim, 1999:31 as cited by Hilhorst, 2002:6)

Therefore, came to the scenario collaborative funding platforms, known as crowdfunding, which is a small-scale fundraising facilitated by technology, enable to donors -public, private and individuals - send money to support some specific project, but as it was started used by international organizations, then donors could support emergency and disaster areas, complementing traditional funding systems (UNOCHA, 2015).

Crowdfunding brought to aid development sector the possibility to diversify the origin of the sources, bringing private sector and individuals to contribute to the alleviation of emergencies. According to UNOCHA's report, crowdfunding removes intermediary funding and moves one step closer to direct assistance (2015:6) by automatizing the funding receiving process, but what this really makes, is keeping ICT companies perpetually as a new intermediary for the aid system. In addition to this, the scope of the crowdfunding is limited, it solved some the way funds are receiving from donors, putting the money in a pool in an automatize way, but issues regarding to allocate properly those sources while been accountable to donors, is still an issue for aid providers.

In order to build donors and general trust through crowdfunding, according to UNOCHA (2015), it was necessary to identify all risks funding a project, the risks delivering aid to the emergency locations and the risk of the platforms, which made a lot of crowdfunding platforms companies got accreditation on best practices adoption for crowdfunding. Some of them additionally offer a warranty to donors when the objective was not reached, money was returned to them, trying to increase donor's engagement (2015). Regarding this, in my opinion, what this system did was basically replace the old intermediary to become the intermediary with a centralized system; which even benefits the fund pool coordination, but still trust relied on system owner and creator. On addition to this, as UNOCHA (2015) said it on its report, being an UN agency on partnerships with the ICT crowdfunding system companies, brought trust to donors because the agency was the trust agent in that relationship.

Despite the efforts to convert crowdfunding into a trustable system increasing audit processes, adopting best practices in the operation of crowdfunding globally platforms, creating warranties where if the fundraising goals are not met, money will be returned to the donors and creating reports to donors about money management, investments and so on, expectations were higher than how reality was on crowdfunding for international organizations, because as I mentioned before, this system just allowed aid assistance to get different fund sources, but the gap was how to take that money in an effective way rather than traditional financial systems. Besides, trust in development aid is not only built on how effectively fund money is collected, but also if it can be traceable until the ultimate destination with immutable and transparent processes, which makes more complex the trust building among all stakeholders.

Two exploratory studies on literature, suggested crowdfunding projects mostly succeed by narrow margins or else fail by large amounts (Mollick, 2014) and succeed appears to be liked to certain project qualities and by a large number of funders, this latter when it is about entrepreneurial projects (Mollick, 2014; Gebert, 2017), plus, backers have no guarantee if their funds are going to be used properly (Wallace, 2019), endangering trust donors in charity programs and making aid providers and ICT companies for a desperately seeking of technological solutions for current problems.

Since blockchain came to life, ICT companies and international organizations started to explore with it, in order to enhance the current crowdfunding benefits and try to cover its gaps. In the industry, there is a large number of companies developing crowdfunding and fundraising schemes supported by blockchain for humanitarian projects, as example AidCoin, which is the ERC20 token provided by AidChain, the platform base on Ethereum blockchain combined to AIDPay which is a payment gateway, allowing to receive different currencies to convert them into AidCoins and finally to be distributed on available projects. This tool enables the donors have an electronic wallet to store and donate easily, also donors could track their donations and allows donors to connect with all the actors involved in the non-profit sector to run fundraising campaigns, executing smart contracts (Aidcoin V.04, 2018).

Blockchain technology increase the *security* to fundraising processes to international organizations and aid providers, to the extent that donors, based on the information stored in the blocks regarding the aid organizations, projects, locations, beneficiaries, response, project timeline and so on, could deliberately decide when and how invest in a particular project. Blockchain *immutability* permit provide a stronger and sound *trust* to donor's data and transactions since information can not be changed, distorted or manipulated, avoiding any fraud attempt in delivering the aid processes, overcoming any information asymmetry presented on old funding systems. It is also important to point out that, as blockchain keeps all the records of the transactions made through it, they are available to be consult by donors since moment zero when they proceed to transfer the money to the projects or beneficiaries. This totally transparency happens in public open ledger source blockchains but not in private blockchain environment, where information could be manipulated by the central party coordinator and as it does not count with the trust protocols of public blockchains.

Since donors can take a look of every transaction made with their money until it reaches the intended beneficiary and every money movement and flows, *traceability* offers to donors all information necessary to take informed decisions regarding their charity investments. This is a positive aspect for charity system and for humanitarian and development aid system, increasing transparency and enhancing relationships between donors and aid providers and international organizations, therefore as a consequence, increase *trust* on donors in the whole system.

In total decentralized systems running a cryptocurrency, there will not be those middlemen presented on traditional funding collecting and aid tracking systems, neither financial institutions which used to facilitate the money transportation until its destination. Obviously, money will come out from some place and it usually does from traditional bank accounts and even if it is converted to cryptocurrencies on the fundraising system, it also could go back to traditional banks accounts to deliver the money to beneficiaries, but strictly talking on managing the funds tasks, banks are been replacing by basically, ICT companies softwares. When a crowdfunding/fundraising system is built based on

Ethereum blockchain, donors can enforce negotiation of a specific rule to facilitate the fundraising process through smart contracts, this help to add a layer of security to effectiveness of donations, transfer funds only will be made to expected recipients when specific conditions are met, avoiding situation as happened in Haiti after the earthquake in 2010 where The Red Cross misused donation funds destined to relief the disaster area (Aidcoin V.04, 2018).

This feature of smart contracts could be important due to urgency to relief the consequences, the disaster area should be recovered, and victims have to be taken care of. Then, implementing legal standards to smart contracts¹⁴, could avoid the long contract negotiation process between organizations and third parties such as health, food and shelter providers, increasing the time response to the emergencies. Pisa and Juden (2017), brings an example on how smart contracts could be used in aid assistance: “in the context of humanitarian aid, an aid organization and a potential recipient (e.g. a national government, local government, or individual) could agree to a contract that would pay cash or provide a voucher if the intended beneficiary is in a region affected by a natural disaster. This contract could even trigger automatically based on data provided by a weather service. Such an approach could increase both the speed and the transparency of aid distribution”.

Reducing fee cost and exchange rates could be reduced until certain point, because as it was said before for crowdfunding systems, now these schemes even the ones supported with blockchain technology, have new intermediaries, the platform providers that usually charge between 3-5% of the funding to support the platform growth (Mire, 2018), mining the possibility to the technology to scale up to become cheaper and more reliable for aid assistance scenario.

When *accountability* is about, literature define it as ‘the means by which individuals and organizations report to a recognized authority, or authorities, and are held responsible for their actions’ (Edwards and Hulme, 1996:8 as cited in Hilhorst, 2002:11). Hilhorst (2002) continue stating ‘to be accountable organizations have to be transparent and responsive regarding their compliance with agreed standards on organizational policies and practices’. In this sense and to narrow down the idea blockchain is the magic potion, not by just put money on blockchain means magically and automatically accountability will appears on donors and charity system eyes. Accountability comes with an adequate manage of the money in development sector, that could be verifiable where and on what is invested in the manner it was proposed by international organizations and aid providers in order to achieve the final objectives of the projects and investments. To be accountable, those processes have to be traceable and transparent, characteristics blockchain offers, where transactions and flows can be visible to everybody in public blockchains, as a social audit, adding an extra layer transparency to the fundraising/crowdfunding system. But accountability is a double way thing, accountability is not only to donors but to beneficiaries, delivering as fastest possible the aid to relief their situation, managing properly donations funds and properly managing their data.

As any technology, blockchain could address some current problems for aid distribution system, specifically in this case for collecting and tracking fund donations, but it also brings new problems or withdrawals. Some of them have been mentioned already along

¹⁴ Smart contracts cannot be implemented on Bitcoin blockchain due the way it was designed.

this chapter, however, the most notable issues are going to be mentioned below regarding this topic.

One of the biggest risks literature shows of using open ledgers blockchain for collecting and tracking, is the privacy of sensible data that is exposed and recorded perpetually in the system from donors and aid providers on one side, and final beneficiaries on the other, mostly when aid programs of any kind are conducted in complicated conflicted or emergency scenarios. The username when somebody open an account in any of these systems would be shown on the system codified, the real problem is when in the blocks will be recorded information of one of the stakeholders, such as donors, beneficiaries, partnerships parties among others. In an open ledger system, all information will be there, exposed to be seen by anyone, at least those risks are needed to be taking in consideration while designing the tool to keep the privacy information of all involved actors, especially data from vulnerable people, in order to uphold the principle of ‘do no harm’ while executing aid processes.

Zwitter and Boisse-Despiaux (2018) regarding this issue, highlighted the importance to keep the privacy of the sensible data on funding processes on behalf aid providers, putting as example of Western NGOs and UN in 2003 during Iraq war, where local insurgents took repercussions against aid providers thinking they were mere tools or spies of US government, this situation end up many organizations had to keep their funds and partnerships secretly to get access to the field.

On this matter, European Parliament on a study conducted by the Scientific Foresight Unit -STOA for the Panel for the Future of Science and Technology, regarding the blockchain and de General Data Protection Regulation – GDPR, brought a possible technical to achieve the right to be forgotten. The solution to this principle on blockchain found by French data protection authority, was the destruction of the private key which would have the effect of making data encrypted with a public key inaccessible, then ‘erasure could be obtain where the keyed hash function’s secret key is deleted together with information from other systems where it was stored for processing’ (European Parliament, 2019), however this topic still needs further research in order to combine public permissionless blockchain with data protection regulations.

Other issue for funding collecting and tracking systems with cryptocurrencies is the price fluctuations and cost trying to exchange Aid Coin into local currency until they scale up enough to be used widely. For so, all involved actors have to learn how cryptocurrencies works, its market and its risks, the use of electronic wallet and exchange market as well (Tambanis, 2019). This for sure this will take a long process while aid funding issues have to be addressed promptly mostly needs of people in need.

4.2. Digital Identity

Before getting into the discussion on how identity has changing with technology and current concerns that it brings, it is necessary start from the basic, how is defined, its different meaning and why it is so important for economic development sector. Identity has a lot meaning in social studies that goes from sociological, political, legal, psychology, philosophy and even the concept has transcended to computer sciences. Identity has evolved in many grounds as well like cultural identity, gender identity, religion identity, social identity and there are much more. In general terms, personal identity are the properties that makes feel people special and it distinguishes each person from another (Ghazi, 2014).

Identity, Digital Identity and UNHCR Digital Identity Meaning

According to The American Heritage Dictionary of the English Language (2019), identity is also related to the 'information such as an identification number, used to establish or prove a person's individuality, as in providing access to a credit account'. This meaning brings the notion of identity relate a number. Nowadays, we have a identification from the place we work, from the tennis club and of course, the legal identification that state grants to their citizens, with that identification people become subject of rights and obligations, and gives individuals get access to health and educational services, is needed to open a bank account, to get access to credits, to vote and welfare benefits (World Bank Group, 2017), and even to pay taxes.

In order to prove that you are who you say you are is fundamental for most of modern interactions (Taneja, 2018). For so, governments issue identity documents, passports, banks issue bank account cards, when you open an email account, you must have a username and a password, your employer issues a card that identifies as an employee, and like those, there are thousands of examples.

The notion of identity has extended that much that not only is for humans but to everything, a house has an identity number in land registry, cars as well, animal can now being identify with an intradermal chip, internet terminals have a number known as IP address. In computational sciences, the proof of your identity is called authentication, which is the process of establish someone's identity to provide access to authorized computer resources (Ghazi, 2014).

In computer and information sciences, the concept identity is compound of a ser of digital records that represents an individual, they are saves and managed according to some entities formats to provide the required identity information to complete transactions. The digital identity enriches integrating new records to create a robust view of the user (Kikitamara, 2017), in this sense, digital identity determines who you are according of your records within the virtual world, it is a summary of your government legal identity registries, on your credit and financial records, your criminal records, on what you buy by internet, on what you search by the web and so on.

From a functional perspective, identity is a sum of attributes associated to a person, like age, height, birth date, birth place, fingerprints, etc; attributes added by time such medical records, communication metadata, digital preferences and designated attributes like telephone number, passport number, email, etc (Pleukchat, 2018).

International organizations argue that digital identification has the potentiality to help refugees and displaced populations that do not count with any official identity document (Ng, 2017 as cited by European Parliament, 2019), first to could identify themselves, second, to get access within the aid assistance system and third, to not be deported or . In this sense, in order to address people's barriers by not having any identification, international community had set the objective 16.9 of the UN Sustainable Development Goals, by which legal identity should be provided for all, including birth registration by year 2030 (United Nations, 2015).

UN Refugee Agency strategy for digital identity programs, is based on three objectives, the first one, is empowering refugees, stateless and forcibly displaced persons, asylum seekers to have a legally recognized digital identity that could be portable and valid across borders and be used in a self-determined way by each user, in order to get access to different services, digital as internet, mobile phones and economical, as access to jobs, remittances and much others; the second one, is straightening the state capacity, consisting in help to integrated national identity systems receiving support from UNHCR and assist state to register and document all individuals to conform with international standards of data security and privacy; and the last one, improving service delivering among the different objectives of the UN agencies (UNHCR, 2018).

Biometrics

This term is used to describe all technical processes that involves the collection of biometric data of an individual in order to conduct its authentication in a certain system solution (Rahman et al., 2018). Biometric data is defined as “any automatically measurable, robust and distinctive physical characteristic or personal trait that can be used to identify an individual or verify the claimed identity of an individual” (Woodward, 2003 as cited by Rahman et al, 2018). Commonly, biometrics refers to fingerprints, face print, iris scans, which are currently broader with innovation in technology, bringing voice prints retinal scans, vein patterns, tongue prints, lip movements, ear patterns, gait analysis and DNA (2018).

Biometrics gives unique and immutability information of individuals due to unique characteristics of each human body, different from names, identification numbers, addresses, e-mails and much others than can be easily changed facilitating frauds. Biometrics have been integrated in daily basis technology, currently there are technological devices such as mobile phones with fingerprint and face recognition to get access to its functionalities. There are technological devices as personal assistants with voice recognition, that can tell you daily news, forecast, how is traffic in your town, help you schedule appointments and even you can ask the devices to control the ambient music, curtains and lights at home, an example of those devices is Siri from Apple and Alexa from Amazon (Perala, 2017). In reality, the technology is not the real problem, is the misuse, the abuse the not adequate storage in privacy of that data, due to biometrics contains an intimate information of individuals, which for most of regulations is considered as special o sensitive data and has special legal protection.

One of the most common uses of biometrics is in voting processes, which it has decreases fraud and votes manipulation cases but also raised concerns on relation to individual's sensitive information management.

Regarding so, Iverson and Garland (2019) conducted a survey for the Institute for Democracy and Electoral Assistance – IDEA, where found 35 per cent of 130 surveyed countries, capture biometrics data for vote registration processes, 25 per cent of surveyed use that biometric information to identify voter at polling places to compare voter appearance against the biometrics data base and finally, the 9 per cent of use biometric identification system where a computer verifies voter’s identification. Some other countries use photos, fingerprints scans and still many others collect signatures in addition to photos and fingerprints.

One of the key findings of this study (2019), is there are certain communities reject biometrics identification due to their cultural and belief practices, they brought examples such as the Papua New Guinea electoral system is ‘heavily inflated and can be subjected to abuse’ and there are negative rumors about the malicious intended on people’s biometrics collection. One concern of the results of the mentioned survey, was biometrics needs the support of technology experts who are not usually electoral authority employees, relying the trust on citizens biometric data on technological private data and developers companies, which usually are tight by confidential contractual clauses, but still is a big risk they can have access to citizens’ sensitive information databases.

Garland (2019) also present a similar situation presented in rural areas of Nigeria, where it is a belief photographs could expose people to occult practices by their enemies. This particular case says a lot regarding ‘accountable technologies’ (Jacobsen, 2018) are implemented on treated areas heading to improve upward accountability -to donors, but causes risks on downward accountability – to aid beneficiaries, due to the marketization of humanitarian practices set pressures on aid providers to take those tools like biometrics, cash-based solutions (2018), as the case of blockchain, without having in mind communities culture, beliefs or practices.

In fact to reinforce the marketization of the humanitarian practices, these cases are the best examples on how technology is presented as non-political tool, but in reality they all are linked to “specific forms of political organization and structures of power” (Jasanoff, 1995 as cited on Jacobsen and Sandvik, 2018) and, blockchain is not an exception on that. In the same sense, Informant 4 pointed out referring to ‘blockchain as a political weapon from any point of view’, stating ‘there are a lot of influences of blockchain people on politics’.

Some Cases of Digital Identity and Biometrics in Humanitarian and Development Aid Contexts

On fragile contexts, where usually people ran away to save theirs and family lives from internal conflicts in their countries, migrate to foreign countries to seek for asylum or for help to international organizations refugee camps are the only solutions available if it try survival is about. On those conditions, victims usually do not count with a legal document to prove who they are; for these kind of situations, digital identity has been applied for emergency responses and aid delivery on humanitarian and development projects. Automatization of registry with technological solutions could smoothing processes in order to grant assistance services such a healthcare, education and distribute aid amount to beneficiaries. According to a study conducted by Desai et al. (2017) for The World Bank Group, it is estimated that around 1.1. billion people worldwide do not have a legal identity proof, situation that reduces the quality of life and opportunities to

have access to minimum services. The same study shows 1.1 billion, 78% live in Sub-Saharan Africa and Asia, 40% are children under 18 years old and one of six are under the age of five and finally more than the half live in lower-middle income economies.

According World Bank (2015), in Botswana through digital identification and biometrics, there was a 25 per cent of savings in pensions and social grants when checking duplicated records and deceased beneficiaries. In the same line, Dahan and Sudan (2015 as cited by European Parliament, 2019) found that the implementation in 2010 of the Guinea-Bissau digital identification program, reached to identify 4.000 non-workers of the public payroll and Nigeria found 43.000 ghost workers in the first phase of the digital identification campaign, saving USD 67 million.

An example of digital identity with biometrics, is the pilot program World Food Programme is conducted since 2017 in UN for Syrian refugee camps Azraq and Zataari, located in Jordan. The first experimentation was done in Sindh province in Pakistan, where from collected evidences and making more robust the blockchain system, was decided by the UN agency to implement it in Jordan in partnership with UNHCR.

Therefore, Jordan pilot was based on Ethereum blockchain with trust protocol called 'Proof of Authority' (Dhameja, 2019), meaning in blockchain technical language, that only can validate transactions in the network, those who only count with a permission to participate in it, which makes conclude is a private permissioned blockchain network, implications that will be highlighted in the next chapter.

Basically, the pilot started with 10,000 users in 2017 and the process consists first, in register every refugee living in the camps collecting their personal information and biometrics, scanning their iris, recording this information with personal data in the blockchain and when finding a refugee lacking of an identity document to provide it to them, second, for each refugee, WFP opened an virtual wallet account to receive the aid amount, and finally third, the refugee can exchange the virtual aid amount in a program affiliated shop and with eyes iris scanning, the cost of the food, is withdraw from the refugee's virtual account (2019), this cash-based transfer system is going to be broader discussed on the chapter 4.3.

Using biometrics is not the first-time international organizations experience on their projects but is the first time is mixed with blockchain. This latter project has been a big concern among aid sector, due to previous experiences using biometrics for projects in conflicted areas by authoritarians' governments and institutions could get more risks than benefits.

One of the biggest technological failures experiences for UNHCR, it was in 2002 when introducing iris recognition to repatriate Afghan refugees followed by the fall of the Taliban regime in 2001. Then the project started helping Afghan refugees living in Pakistan camps to their original country and to register them in a data base, UNHCR used iris scanners to differentiate original refugees from false ones who were trying to claim a second aid package. Suddenly, the solution started to fail resulting a significant number of false matches, due to as it as first time implemented, the technological solution was built in a small-scale, resulting inefficient since the large number of refugees to register and match the iris on existing templates, leaving original refugees without the aid amount (Jacobsen, 2015).

However, it seems according to Jacobsen (2015) cash-based transfer in those refugee camps using biometrics were employed since in 2014 and iris scan were implemented to facilitate refugee's registration and to avoid double registration as well. This time UNHCR did not have covered refugees living outside of the refugee camps, but implementing withdrawals through ATM with iris scanner, they overcome the situation of not having included the urban refugees, experiment that seems to work out at the end but what Jacobsen argues is Syrian refugees have become subjects of experimentation with technology without having on mind of the negative consequences that can brings, though there have already cases of biometric data leaked to Syrian authorities with implications to those who returned and data was also shared between humanitarian actors, private partnerships and others government authorities, such as Lebanese who were trying to enforce a new strict regulation about refugees (Iris-Guard and the Amman Cairo Bank as cited by Jacobsen, 2015).

Those are the reasons why the use of biometrics has elevated such a controversy in all local and international settings by the vulnerability of the victims on fragile contexts and among international community there are a lot of criticizing's on programs using digital identity, biometrics based on blockchain ledgers, as Informant 6 stated.

Digital Identity + Biometrics + Blockchain = Trust?

Having established the scenario where sensitive data and biometrics navigates on fragile environments, where technology by one side adds a new layer of complexity to already complex context, threatens the neutrality on aid assistance and exposing "vulnerable subjects to additional sources of harm" (Jacobsen, 2015: 2). Then what could happen if a new information solution called blockchain step into conflicted contexts to manage biometrics? Blockchain technology characteristics emend current management problems of digital identity on aid assistance delivery?

In order to analyse which could be the implications on using blockchain to digital identities and biometrics, first, is convenient to mention that current blockchain solutions used by international organizations, are built to run in private permissioned environments, this means, supported on technical blockchain bases contained in chapter 2, it has some specific consequences: they are *centralized* solutions conformed from trusted parties, in which one of them relies the responsibility to grant admission to participate to others and, sometimes on the same party converge the power of validate the transactions, this party has totally control of what happens among the network and at the same time, that power let the controller excludes people that do not qualifies with networks requirements, so does not qualify as censorship proof tool since not any individual can join. This is very far from blockchain public permissionless aims.

Well, the fact digital identity with biometrics running in privates blockchains, does not necessary mean is a bad solution, it does not fulfil the requirements to the digital democracy public blockchain claims, but it has a really strong reason: protect personal and intimate data of vulnerable people. When having cases against of misused of technology with refugees sensitive information, and having in mind public blockchain are transparent due to everything in the block is visible, the better aid providers and ICT companies can do, is maintain as much as possible the privacy and the security of people, even

though blockchain purist critics based their arguments in technical reasons to consider private blockchains as no real blockchains.

All seven Informants defended public permissionless blockchain as the most *transparent* tool due to its characteristics, which is demonstrated useful for financial transactions, or to show accountability to donors, or even when donors are governments, they want to be accountable to their citizens regarding public spending, to try avoiding corruption. The real problem is when sensitive data of vulnerable individuals in complex politics contexts is not properly managed by organizations or by the third parties such as ICT companies by been technology providers, have access to that information. Then openness could difficult even more the situation of the victims, putting their life in a total risk, then the aim to help people, results aggravating their struggles, as cases Jacobsen (2015) described.

However, even when private blockchains could be a tool to keep vulnerable people's sensitive data, this tool would not avoid the controller or any participant in the private network become corrupted or just come up with sharing the biometrics data with the host governments or other parties with flagitious intentions on that databases. So, it is not technology's fault the mismanagement of information, is the one who control it, and that what exactly happened when biometrics data were shared to government case cited also by Jacobsen (2015).

In the case digital identity and biometrics information running on public blockchains is still a concern and research on this topic would help to develop a bit more this topic, as they are supposed to be more secure than private ones, but until now, this *security* has been prove for financial transactions which is the objective blockchain was created with bitcoin; but it could be really dangerous put personal data as biometrics on public ledgers by overexposure of vulnerable subjects biometrics information to everyone's sight. Other concern about biometrics on public blockchain will be the right every person has to choose to be forgot of a database, as immutability is one of the characteristics of blockchain, 'deleting data from DLT is burdensome as these networks are often purposefully designated to make the unilateral modification of data hard, which in turn is supposed to generate *trust* in the network by guaranteeing data integrity.'

Currently there are some initiatives adding public decentralized endpoints to verifies digital identities and are controlled totally by identity owner, independent from central registries, authorities or identity providers, with credential schemes, with revocation protocols of registries and proofs of consent for data sharing (Tykn, 2019), that according to this idea, could be make possible a self-sovereign identity, but personally, there is much more to scale on this and it would take time and resources to get until that point.

Whether private or public blockchains for digital identity and biometrics, some of the blockchain characteristics improve the privacy of the data, but lack of transparency – in private environments, and when runs in public blockchains, there is a lot of transparency but privacy is really limited, even more when interventions are made in political and social conflicted areas. This idea is supported by the CEO of Colombia Fintech on his words:

'Transparency and trust depend on the type of operations you are going to perform. Transparency is very important for operations such as contracting, the distribution of

public resources in systems that manage the general budget of the Nation, but as a system for payments of natural persons¹⁵, it seems a bit dangerous considering the conditions of Colombian public order’.

In order to conclude and based on the opportunities, the risks and some challenges blockchain brings for digital identity with biometrics on implemented programs where governments identity registry is inefficient, international organizations must build trust among institutions and vulnerable populations, stablishing standards and propose regulations to protect beneficiary’s privacy and information rights. Regulations would assure individuals their data rights are protected and would prevent aid beneficiaries when their biometrics are involved, know all the risks technology, in this case blockchain can bring to them, explaining all actors responsibility on keep their data protected from malicious interventions on it, to finally obtain an informed consent.

Additional, to construct trust among the different actors – host government agencies, international organizations, private sector and individuals, digital identity with biometrics based on blockchain, should be design where accountability goes not only upwards to donors, but also to assure beneficiaries their rights and personal sensitive information and how to use properly their data.

For so, International organizations should collaborate with host governments to make robust their privacy data regulations, in order to build trust on beneficiaries assuring their rights are protected in a comprehensive legal framework, which would avoid the unnecessary intromission on people’s personal sphere.

In the same line, international organization, other aid providers and all involved actors should be tight by data privacy strict agreements with strong penalties, in the event they violate any agreement on maintaining data privacy, misuse of it or any other behavior that may harm the owners of sensitive data.

4.3. Cash- Based Transfers

Providing cash transfer to alleviate the consequences of emergencies or conflicted states or communities, have been effective for donors and international organizations on their mission to contribute to relief famine and poverty of individuals. According to the World Bank (2018), only forced displacement is continuous growing, data shows there were 70.8 million refugees internally displaces and asylum-seekers by the end of 2018, from which 84% are hosted in developing countries, the 67% of all refuges worldwide came just from five countries and nearly 4 in every 5 refugees have been displaced for at least five years.

Conflicted-affected countries as it was noted before in this paper, usually characterizes by weak institutions and thus, institutional capacity is almost inexistent, there is no much infrastructure even more after a war or a conflict, situations that exacerbates poverty, according to the Holmes (2009), in best cases of rapid relief, conditions pre-war could take a generation or more to regenerate.

¹⁵ Informant 7 said this because of private data exposure operations can bring.

With in-kind aid, cash is one of the most traditional modalities to deliver aid, but the difference with cash-based transfers could be used for most of the aid cluster on aid responses – food, water, sanitation, health, education, etc., it promotes beneficiary choice and flexibility. Cash-based transfers have evolved with time and technological innovations have robust the ways it is provide, then actually, could be identified various types of cash transfers aiming delivering aid (Fabre and Aggiss, 2017):

- *Unconditional* – which recipient does not have to deploy any undertake action to receive the cash;
- *Restricted transfers* – aid providers gives restrictions on cash expenditure on pre-determined items;
- *Conditional Cash*, beneficiaries should do in return to receive the cash like completing a task related with the objective of the program;
- *Vouchers*, could be in paper, a token or electronic card that can be exchanged that could be exchange by money or physical pre-defined goods or services at designated vendor;
- *Multipurposed cash transfer*, which has no restrictions and the given amount of money is to contribute to cover household basket;
- *Cash for work*, this modality is provided as a condition of undertaking designated work and is determinate with some specific evaluations criteria usually the work is part to contribute community work;
- *E-transfer*, it is a digital money transfer or vouchers from the aid agency to the beneficiaries, so individuals can have access to cash, goods, services, it could be done through mobile devices, electronic vouchers or cards, with this modality individuals can also withdraw the money via ATM and also can be done without the need of a bank account;
- *Social Protection*, referring to comprehensive systems to address risks, vulnerability and chronic poverty, could be carried out by the state, partnerships or by the private sector;
- *Social Safety Nets*, this is a sub-set of social protection systems, in order to target poor and vulnerability with in-kind food, cash or vouchers.

International organizations and NGOs based on their own experiences and others aid providers experiences have assessed different cases to determinate the kind of aid modality, based on certain criteria, as such magnitude of the crisis context, the target interventions, availability and access of markets, the available local financial intermediaries and also the settled objectives of the international organization for the crisis response.

The current aid modalities, have enable International Organizations to provide assistance to people in need, but their deployment also brings collateral consequences to the local economy, since their implementation depends on the markets, the intermediaries and other factors that can influence the increase in costs and also could arise the inherent risks of financial mismanagement and the security of the beneficiaries personal data (Innovation Accelerator WFP, 2019).

As with cash, risk aversion prevails (Fabre and Aggiss, 2017), and due to the associate risks cash brings on its management, conducting assessments on the programs and

projects, international organizations and NGOs have identified those risks in delivering and distributing by any of the current aid modalities, but focusing on cash delivery and distribution, depending on the stage of the project, some recommended measurements should be applied in order to minimise those risks. As an example, Oxfam (2006) for cash delivery stage, for cash targeting and for distribution and retention by beneficiary stages, could be identified as risks theft, looting, diversion by local elites, authorities and warring parties and attacks on way home after distribution and taxation. Therefore, the measures applied for Oxfam, were transferring the money to beneficiaries' banks accounts, in order to rely on banks the trust to secure the transactions and, so beneficiaries could withdraw money at demand, other action taken was monitoring the community, limited payments information to few people, decentralised distribution so transportation will be by smaller amounts of money, varied payment days, informed the community aid will not continue if diversion or threats to security occurs, among other measurements.

As could be seen from the literature, in order to secure the transactions and to administer the risks delivering cash brings, international organizations and NGOs usually remit aid money through banks and financial intermediaries, who realize the task to transfer the money from international organization bank account to beneficiaries' bank accounts. Cash transfers could take considerable time due to intern process banks has to manage risks as regulated institutions, in order to comply with antimoney laundering and financing terrorism risk management processes for each of their clients. Banks also to process money from transfer, takes between two or three business days to reconcile money and other information, even more when international transfers are about. Cash flows for traditional transfers could be seen in Annex 3.

Technology evolution has provided favourable environments to use cash, making donors put some pressure to international organizations to do a transition on their programs payments from cash to electronic, promising to increase transparency, reducing corruption, decreasing transaction costs and facilitating access to financial services to beneficiaries (Gentilini, 2016). Comparing e-transfers with the traditional transfer process, the first ones are more efficient, safer and cost-effective and it is must more discreet for the recipients. The e-transfer comprehends smart cards, mobile vouchers or mobile money with a certain purpose, providing by banks or by mobile phones service companies, supported by ICT companies. Areas where displaced people need assistance, often counts with coverage of mobile services than banks offices by the area, that is why mobile money is more widespread than cash in those cases (European Parliament, 2019).

One of the most significant example of mobile banking systems is M-PESA, targeting the unbanked and prepaid segment of the population in Kenya, introduced in 2007 by Safaricom, funded by Department for International Development, part of UK government, in conjunction with Vodafone and UK telecommunications company. Beneficiaries in this programme could realize various financial activities such as check account balances, deposits, withdrawals, transfer money among others, without having a contractual relationship with the bank, then the money was reflected on a virtual account, all conducted from a mobile phone. In order to get the transferred money from other individual, the recipient had to visit a retail agent, in order to provide the identification, verify the transaction number and convert the electronic money into cash (Morawczynski and Miscione, 2008) The cost of financial remittances in Kenya after M_PESA got into the market, "cost of sending US\$100 domestically was US\$12 by MoneyGram, US\$20 by bank wire, US\$6 by postal money order, and US\$ by bus, compared to US\$2.50 by M-PESA" (World Bank, 2016).

In order to analyse the foundations of the digital revolution and how technology is transforming the economy, accelerating growth and expanding opportunities to poor and disadvantaged people, in 2016 World Bank conducted a study in which digital payments has an special attentions due to the fast benefits it brings and the accelerated growth it created according to the data reported. One of the findings World Bank had is internet allows to automate components, reducing cost of many financial transactions, benefiting since the Government to individuals. They also found with electronic payments created transparent digital records that can be traced, the probability funds do not reach the addressee or a duplicate payment or payments to unknown beneficiaries are lower, since a case in India the security increased with smart cards rather than cash. Additionally, it was found all this advantages of automating processes facilitated the analysis of credit scores with massive data of individuals, so they could access loans at lower time and brought to the financial services, fintech companies whose services are lower than traditional financial service providers, and finally, the peer-to-peer transactions started to operate without financial intermediaries instead of matching consumers with lenders, and this is where first bitcoin with cryptocurrencies and after blockchain got a space on the industry.

In research literature, there is an study conducted by Morawczynski and Miscione (XXX) where the trust in mobile banking transactions were study, analysing the case of M-PESA in which they found first, M-PESA costumer did not trust the agents, where beneficiaries had to register in, for the management of their money. Those agents received complaints regarding malfunctioning of text message system of M-PESA on peak times and then transactions used to fail at the time. The transactions were not properly processed in the system or not confirmed to the customer and then usually agents were blamed because of the system failures, according to the customer interviews the researches conducted on field work. The conclusion on this regard, was they found the relations ships between customer and agents weak caused by application functioning. On the other hand, consumers trust Safaricom due to the company has a large trajectory in Kenya providing mobile services and then customer had faith the institution will protect their money, faith given by the trusted institution leaders, as other of the findings, believing they were political neutral affecting in this case positively to the company. Thus, these findings shape the trust customers had with the mobile payment system in Kenya.

Getting back to peer-to-peer transactions in a *distributed* ledger, as one of the most important features of it is there is no middleman involved in the validations of transactions. This characteristics gets more sense on financial transactions on one hand, because as before in traditional transactions was included banks providing their platforms in order to deliver the aid disbursement to beneficiaries through cash, there is a considerable reduction of cost that before was given by automation of processes; and by other hand, aid is provided in states where corruption is predominant on their institutions, blockchain allows to transfer the aid money directly to beneficiaries than transfer it to host governments. This gives a plus to blockchain, not only on its performance but also to reach the beneficiaries promptly, effectively and *transparently*, reducing the risk of misappropriation of aid by corrupted parties.

With blockchain whether public or private environments, *traceability* could help the current lack of coordination among the action of the different donors and organizations, is estimated there are over 21 multilateral organizations and 45 countries providing funding for development, which often felt into the same population (Lawson, 2013 as cited

by Pisa and Juden, 2017). Coordinating different donor's interest, different procedures, different standards, different administrative infrastructures, have always been a challenge for international organizations to manage in order to deliver aid efficiently to the beneficiaries and try to be as much as accountable to their donors. Thus, in this aspects the automatization of the systems plus the *traceability* and *immutability* grates blockchain transactions as every money movement since donors funding until beneficiary receives, and that could help to cost-efficiency of the aid, avoiding double unnecessary expenditures in the same project, in the same subject or paying more bureaucrats doing the same task, which would increase donors trust on the effectiveness of charity system as well.

At the same time *traceability* and *immutability* increases, *transparency* could arise for all involved actors in aid distribution processes, in the sense records on blockchain ledgers cannot be subjected of modifications by the parties, which avoids corruption, money deviation, false accounts or beneficiaries, on which cited literature and informants coincides. Also, this features plus the automation of the processes, could reduce dramatically administrative roles that before use to validate transaction records, since all participants in the network can view the same information at the same time (Pisa and Junden, 2017). On this regard, informant 1 pronounced on this matter saying some people are going to be jobless on administrative positions and blockchain technicians are going to be more demanded as blockchain projects in humanitarian and development aid increases.

But immutability, traceability and automation of transaction process are not going to build data analysis or reports by itself, in turn, agencies and organizations will have to get specialized on how to analysed data on blockchain ledgers, to monitor and report project data and analyse ongoing projects and activities, in order to give a proper reports to donors about where, what project aid funds are invested and how, analysing financial flows and evaluation metrics. On this respect, informant 7 mentioned in non-developed countries is more difficult to find qualified people on computing science that could develop this kind of tools, which match with informant 5 who assures "computer and devices really make an impact, I remember one professor saying: It's only rich people's thing, only rich people has these devices, and it is not really addressing issues on inequality".

The fact the transactions information is public and everyone can see it, is important to donors, because they can see where their charity funds goes, the money flows, in which projects are invested and which organization is in charge of the project; is important to international organizations, NGOs and other aid providers, as they aid could be properly coordinated and money will invested wisely and effectively and it is important to citizens as well, since they sometimes are at the same time donors with small amounts and can trust on charity system as well. However, is important to note, this features are not totally present in private blockchain, as only can have access who has granted to participate in the network, therefore can be tampered by mutual agreement of the participants, cases on which trust on charity system would not increase and aid providers can manipulate information as their will.

On cases where multilateral institutions such as World Bank, Interamerican Development Bank, Asian Development Bank, etc, implementing blockchain on financial grants conceded to non-developed countries, to carry out infrastructure or social development projects, organizations could check countries' compliance regarding the funding agreements with smart contracts, where disbursements could be tied to performance metrics of the project. Doing so, recipient country is obligated to strictly follow the conditions

imposed by the multilateral organization, strengthen its institutions to be accountable, creating institutional trust as country among the involved actors. Such models could provide more efficiency and less political funding instruments (Zwiter and Boisse-Despiaux, 2018).

There are some ICT companies like Aid:Tech and Diberse offering blockchain solutions to conduct aid transfers. The first one, was the first -in 2015, to deliver \$10,000 to 100 Syrian refugee families through vouchers supported by blockchain technology and with a partnered local supermarket in Tripoli, North Lebanon. Were 500 vouchers worth \$20 each and all were redeemed, the company created 20 fraudulent vouchers to test the security of the system and all of them were failed at point-of-sale. All transactions could be monitored in real time by Irish Red Cross. (Aid:Tech, 2019)

Diberse had two pilots, one with donors, an UK NGO and a Swazi NGO to support education for orphaned girls, which demonstrated to reduced costs of transfer fee by 2.5% and as result, more girls could attend school. (Hunink, 2018)

WFP as an agency of the UN with 'Building Blocks' project in UN Syrian refugees camps, using Ethereum to distribute cash-base transfers to 10,000 Syrian on virtual wallets with previous registration of individuals by iris scanning stored in blockchains. Aid money was disbursed on each of the beneficiary's virtual wallet to buy foods and goods on WFP- contracted supermarket where they get their iris scan again to withdrawal the amount of the food purchased. Due to blockchain characteristics, WFP has every transaction recorded on retailers, facilitating the accounting reconciliation process, that according to WFP were reduced in third party of the costs. The ID biometric systems is managed by UNHCR and its technical partners and WFP only have access to the hashed version of the identification of the beneficiaries which already is anonymous. The project aims to grant participation in the network to UNWwomen, in order to add this agency current projects where actually female refugees get physical cash with all the risks this carry and turn this into cash-based transfer with biometrics as WFP project. (Coppi and Fast, 2019)

To date, those pilots have involved only a single agency, but objective is sharing information among multiple donors and organizations to get into the expected potential point where information could be shared with multiple organizations, donors, governments, auditors and even beneficiaries on one platform, to boost efficiency of aid distribution system. (OECD, 2003 as cited on Coppi and Fast, 2019). This would promote standardization of procedures, transparency to donors and governments integration to budget decisions (2019).

Even with pilot projects the achievement on deliver aid are positive, but when having just one participation in the networks, scalability from the pilot projects will not be easy, due to lack of regulation in some countries about blockchain, when also some organizations and governments are risk averse. Data privacy is still a concern, because even when digitally could be anonymized in the system, the data and biometrics are being shared indiscriminately with various organizations, putting more risks to refugees and victim's life.

Finally, there is still a concern about accountability found on literature, on agencies reports and is they only take accountability in just one way: to the donors as they contribute to the funds to invest on the projects, but accountability also should be to

beneficiaries as the other end of the transactions, they are the recipients, they are the owners of their sensitive data, they have the right to decide what to do with their information, if it could be share or not with third parties, but they are been taken as passive subjects, as they have obliged to trust in the aid system with no especial reason more than to be in need.

5. Conclusions

The research question is going to be limited to the three use cases of blockchain on humanitarian and development assistance, the conducted interviews and related literature do not provide a wide range of how trust could be built for the big untrusty environment that fragility contexts are characterized, not until blockchain reach its level of maturity so all real impacts could be seen; but at least, this analysis gave a glimpse of how blockchain can be a bridge to construct trust or how it could destroy trust in a blink, specially on those weak untrusty environments.

In this sense, trust will be analyzed with every of the characteristics of blockchain according to the study conducted on chapter 4, in order to conclude if blockchain could be a trust enabler for humanitarian and development contexts.

Trust and Decentralization

Decentralization is one of the most important and controversial characteristics of the blockchain. Our current political, social and economic structures are all centralized and people rely their trust on them. Blockchain operates without a central authority using a network of collaborative nodes to validate transactions, there is no a single point of failure and the risk of been hacked is disseminated. Participants is not necessary to trust on each other, because the platform mechanisms swift the trust of people on the system. On fundraising systems, decentralization could give donors and aid providers, the possibility to have a coordinated world aid system, since projects, donations amount, beneficiaries, aid amount allocations and more information will be available to all actors, to provide effectively assistance without duplicate unnecessary expenditures on the same project, avoiding misallocating of resources and increasing trust on aid system. Decentralization on digital identity is still a concern, when sensitive data of vulnerable people is exposed to everybody sight and their life is in danger. Instead, decentralization on cash-based transfers, reduce transaction cost and decrease the latency of international transactions, bringing total transparency, but environmental cost is a heavy concern.

Trust and Transparency

Transparency and trust were the most prominent characteristics of blockchain cited either by literature and by interviewees but, for aid organizations reports, improved efficiency and saving on cost, seems to be more important. As it could be conclude, when more transparency, donors could know if their money goes to the project they invest and allows the aid organization to verify they receive the funding and they allocated properly and they could trace all transactions made with the charity money, as the example of crowdfunding/fundraising systems. When digital identity is about, total transparency is not a good feature, due to the expose of sensitive data of the vulnerable people, aggravating people's situation, then in this case, the trust is totally undermined. Finally, it seems the interaction between transparency and trust is interdependent, while more transparency in a blockchain for cash-based transactions, more trust generates on donors because they money reach the intended beneficiary efficiently, for aid organizations because they are accountable for donors and beneficiaries, and for beneficiaries because they receive the money. Decentralization also foster cooperation between participants, they all have equal status to review and approve transactions.

Trust and Traceability

Traceability is also an important characteristic of blockchain. As all transactions could be seen on the ledger, and all nodes keeps a copy of the transactions, it could be easily trace the money flows in a fundraising since donors gives the money away to the international or to a certain project or even to certain beneficiary; donors trust increased when they can track the money they invest in a certain, secured way and in real time. For digital identity of vulnerable people traceability still will be an issue, they could be chased by authoritarian governments when they are in conflicted situations. Finally, regarding cash-based transfers, is the better way to construct trust, it beneficiates all involved actors of assistance could track and have control of the transactions and for sure, it is a feature on which could trust be rely. Traceability makes avoid aid could get lost on corruption or fraud.

Trust and Automation

A database with automated archive tasks, reduce paperwork and thus, it no necessary intermediaries because of the automated process. When is needed to implement smart contracts, which is coding all agreed obligations of a contract that parties have to perform under certain conditions, when those conditions are met, the contract starts its effects without the supervision on a third party, creating efficiency on reduction costs and all process is accelerated. Automation makes possible also to track lively the flows of money on blockchain, there no need anymore for example for cash transfers, until bank processes reconciliates the money. Automation on the three cases is a good feature , since on the first case, donors should not wait anymore until international organizations prepares the reports, when they have the money flows of their investments, of course, the human element is also necessary when analyzing in a qualitative manner is required. For international organizations, is also a great feature, in order to prepared reports. And finally, for beneficiaries, they also can have control of the flows of their money immediately, creating trust among the different actors.

Trust and Accountability

Accountability is one of the biggest issues to international organizations because is about the quality the assistance is provided, but in literature seems like only upward accountability is important, because the results of the projects and how money is allocated it is assumed only concerns to donors, but nothing is written about the accountability to the end beneficiaries of the program, as beneficiary would be a stone invited of the whole aid chain. On fundraising systems, in an open ledger, as everyone can see the track of the money, the system itself becomes accountable for the participants, even beneficiaries on blockchain could receive aid directly without intermediary NGOs, which could somehow accountable for the beneficiary as well. On digital identity, the accountability for the organizations is provide identity documents to the beneficiaries and register them on the database, only if the consent of the end users is provided, otherwise, accountability is undermining by harming vulnerable populations. For beneficiaries blockchain in this case is accountable just when their data and privacy is totally protected,

Trust and Immutability

Immutability refers to all transactions and information store in the blocks keeps on them perpetually, on the nodes as well. This feature is not different to the three exposed cases. Immutability warrantee to keep records of the transactions and money flows at donors, international organizations and even beneficiaries at demand. The problem is also transversal to the three cases, is when an individual want to be erase from the database, which is commonly called the right to be forgotten, as meaning that person does not want to share its data anymore. This has arisen a great debate among legislators, due to in blockchains are still not possible be erased when they are running in a permission less blockchain y there are still not clear solutions to this, so it has to be subject of future research.

Informants and literature recounted some challenges for blockchain technology namely: *Maturity* – blockchain for development sector is still at the beginning of its stage, to get to the maturity level, requires computation and computation, requires power and time. Here it could be grouped of the biggest critics of blockchain which is the power consumption to get the blocks secure in open ledger environments. *Data Privacy* – the most vulnerable people result to be affected by privacy of the personal data more than any other civilians, due to their life is in danger; still there is not a clear solution to this issue, and international organizations under the ‘do not harm’ principle and tied to data privacy regulations must include at least minimum standards to protect privacy. *Lack of Regulation* – increases knowledge gap of blockchain; donors and international organizations should

promote and advocate for comprehensive and transparent regulations in which include ethics on use of the tool, in order to avoid to aggravation of people's situation.

Tables

Table 1. Four main search strategies

| Research Strategy | Description |
|--------------------------|---|
| Citation Pearl Growing | Phrases or words within retrieved sources are used to retrieve other sources in new searches. |
| Brief search | Sources are retrieved quickly and crudely |
| Building Blocks | Search terms are combined with synonyms and similar concepts |

| | |
|---------------------|---|
| Successive Fraction | Searches are made within a large set of sources to eliminate non-relevant sources |
|---------------------|---|

Source: Rowley and Slack, 2004

Table 2. Search Results

| Phrases | Google Scholar | EUR RePub | ISS RePub |
|-----------------------------------|----------------|-----------|-----------|
| 'Blockchain Technology' | 200 of 12.900* | 13 | 1 |
| 'Blockchain and Humanitarian Aid' | 277 | 0 | 0 |
| 'Trust in Blockchain' | 100 of 6.390* | 0 | 0 |

*Shows only related topics with the research

Table 3. Synonyms and other words - Building Blocks strategy

| Search Concept | Synonyms / Words |
|------------------|---------------------------------|
| Blockchain | Distributed Ledger /DLT |
| Humanitarian Aid | Humanitarian Action/Foreign Aid |
| Fragile States | Fragility/Conflicted States |
| Trust | Untrusted/Social Cohesion |

Table 4. Distribution of informants by position and sector

| Informant | Position | Sector |
|-------------|--|---|
| Informant 1 | Lecturer of International Business Faculty at The Hague University of Applied Sciences | Economics/ Fintech Researcher |
| Informant 2 | Innovation Consultant at The Hague Municipality | Development Sector/Researcher/Expert on Blockchain |
| Informant 3 | Freelance Blockchain Trainer and Freelance ICT Consultant | Expert on Blockchain /Experience in Humanitarian sector |
| Informant 4 | Freelance Software Creator | Expert on Blockchain |
| Informant 5 | CEO Co-founder Humboldt Environmental Systems Inc | Development Sector/ Expert on Blockchain |
| Informant 6 | Multilateral Development Bank on Finance and Technology Department | Economics/Development Sector/Expert on Blockchain |
| Informant 7 | CEO Colombia Fintech | Law/Fintech/Blockchain |

Annexes

Annex 1. Semi-Structured Interview Guide

General Questions:

1. ¿Which is your background? (Education and experience)
2. ¿What is your current position?
3. How are you involved with blockchain technology?
4. On what extent are you involved with humanitarian sector?
5. To which extent are you knowledgeable in the following topics:
 - a) Blockchain
 - b) Humanitarian Aid Supply Chain
 - c) Technology Governance and Ethics

Blockchain Questions

1. How do you define blockchain?
2. Which could be the uses of the blockchain technology?
3. Which are the advantages of using blockchain?
4. Which are the problems blockchain brings?
5. How secure is blockchain technology?
6. How transparency and trust are created and constructed using blockchain?
7. How fast could get a transaction supported by blockchain technology?
8. Who are the parties involved in a blockchain transaction?
9. How accountable are blockchain transactions are?

Humanitarian Aid Supply Chain

1. Which are the problems of the humanitarian aid?
2. Do you think corruption could be avoided with the use of blockchain in humanitarian aid supply chain?
3. Do you know how blockchain is being used in development sector/humanitarian aid?
4. Which are the benefits and problems of blockchain to deliver humanitarian aid?
5. Which could be the changes on the involved actors using blockchain technology for humanitarian aid delivery?
6. How do you see the role of the banks in humanitarian sector before and after the use of blockchain?
7. How do you see the role of the blockchain in development sector, specifically on humanitarian supply chain?
8. Do you think governments are losing control regarding intervened people in their territories with this humanitarian aid delivery modality?



Technology

1. Which are the impacts technology brings on people in humanitarian interventions?
2. Which are the ethical limitations the use of the technology on humanitarian interventions?
3. How people's data/information/assets/etc would be protected on a system supported by blockchain?
4. Why do you think governments wants to control and regulate blockchain?

Closing Questions

1. Is there anything else you want you want to add to this interview?
2. Can I contact you for further questions in the future?

Annex 2. Comparison of different types of blockchain

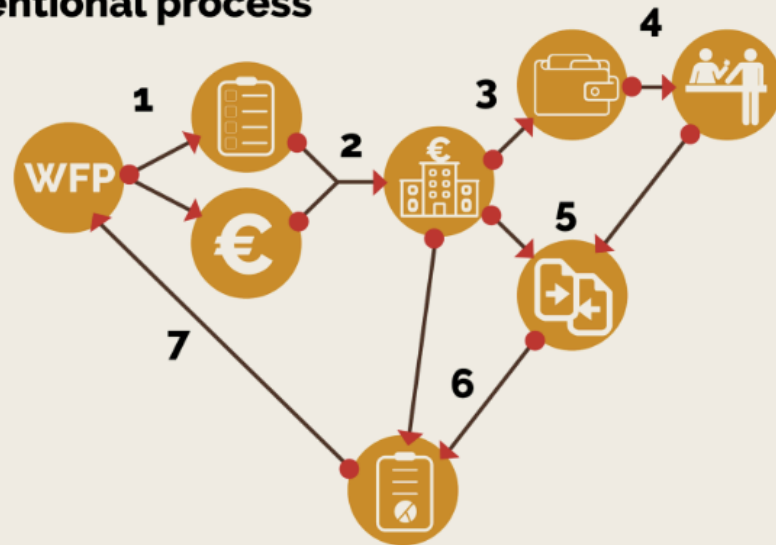
| | Public Bitcoin, Ethereum, Litecoin | Private Hyperledger, Corda, Quorum |
|--|--|---|
| Anyone can join | ✓ | ✗ |
| In general, participants act as nodes | ✓ | ✗ |
| Transparency | ✓ | ~ |
| Only one administrator | ✗ | ✓ |
| More than one administrator | ✗ | ✗ |
| No administrators | ✓ | ✗ |
| No participant has more rights than the rest | ✓ | ✗ |
| Smart Contracts can be implemented | ✓ | ✓ |
| Block mining rewards | ~ | ✗ |
| Solves trust problems | ✓ | ✗ |
| Security based on consensus protocols | ✓ | ✗ |
| Security based on hash functions | ✓ | ~ |
| Provides cloud services | DA | DA |

✓ Yes ✗ No ~ Sometimes DA Does not apply

Source: Allende, 2018

Annex 3. Aid Disbursement Conventional Process

Conventional process

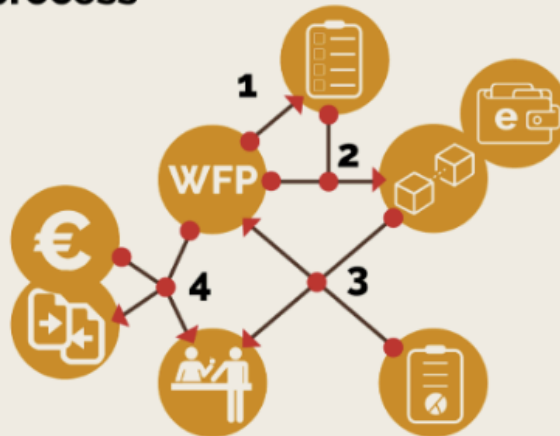


1. The WFP sets up a list of beneficiaries, with their personal information and allocates funds.
2. The list of information and the funds are sent to a trusted third party, in this case a bank.
3. The bank sets up accounts for the beneficiaries.
4. Beneficiaries go to the retailers and purchase goods, e.g. with e-vouchers.
5. The retailers and the banks make up the balances and the due funds are transferred.
6. The banks make up the report of all the transactions during the month.
7. The monitoring report is sent back to the WFP.

Source: Hunink, 2018

Annex 4. Aid Disbursement with Blockchain

Blockchain process



1. The WFP makes a list with the personal information of the beneficiaries.
2. Each beneficiary is registered on the blockchain, thereby gaining an electronic wallet.
3. The beneficiary buys goods at the retailer, e.g. with an iris scan, at which point the transaction is registered on the blockchain

- and the balance is adjusted. The transaction can be monitored in real-time by the WFP.
4. The balance sheet is automatically updated and the funds are transferred directly to the retailers.

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