

Blockchain Smart Contracts for Efficient Disaster/Pandemic Relief & Recovery

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Abstract-Disasters and Pandemics kill thousands of people every year globally. Many people die because of the direct impact of the disasters but many more die because of indirect causes. Some of the indirect causes are: inadequate funds, delay in making resources available to affected communities because of inefficient disaster relief supply-chain. Trust and corruption are few factors behind inadequate funds. Many people willing to help, don't know or don't trust the organisations providing relief efforts. Trust is a very genuine concern as corruption in the supply chain is very prevalent. Lack of central communication between various organisations, volunteers and governments is the reason behind inefficient supply-chain. This adds delay in making resources available to the needy and hence leads to greater loss of life. This paper illustrates some of the problems in the light of the recent covid19 pandemic and presents an approach which could fix the trust issue and also optimizes disaster relief supply chain with the help of blockchain technology.

Keywords-covid 19 blockchain framework innovative approach, impact of covid 19 on blockchain, blockchain post covid, how blockchain technology can help fighting against covid 19

1. INTRODUCTION

Around 60,000 people die every year because of various types of natural disasters. This is 0.1% of all deaths.

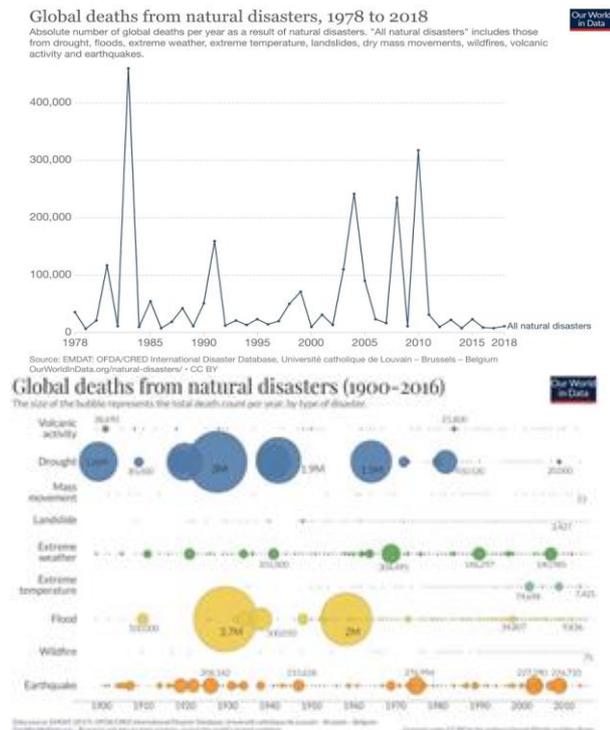


Fig. 1. Natural Disasters.

2020 is especially bad and has beaten all records, more than a million people have died so far because of Covid19 pandemic. More than 35 million people have been impacted.



Fig. 2. Source:

Many countries went into lockdown to prevent the spread of this disease. It impacted the global economy severely and many people have lost their livelihoods. In India millions of people work in big metro cities far away from their native places. These people are on daily wages and are not able to survive for long without work. Government promised to provide aid to these migrant workers but the scale of the problem was unforeseen and it was not possible to make resources available to these poor people. Without public transportation, having no other option, these people walked thousands of kilometers to reach their native places. These included children, adults, old age people and pregnant women who walked in the hope of getting food and resources.



Fig. 3. Source: Amal KS/Hindustan Times via Getty Images.

<https://www.npr.org/sections/goatsandsoda/2020/03/31/822642382/coronavirus-lockdown-sends-migrant-workers-on-a-long-and-risky-trip-home> Many more people died on the way because of these indirect causes than the ones killed by coronavirus.

II. DISASTER RECOVERY PROBLEM

Disaster recovery and relief is the combined effort by Governments, NGOs like American Red Cross, Community Based Organisations (CBO) and most importantly volunteers. Money and resources flow between various hands of politicians, businesses, service industries e.g. Medical Service Providers (MSP), infrastructure providers for transportation, shelters, warehouses etc to end users. Because of the lack of central coordination between various organisations, many times resources reach disaster hit areas late or resources are inadequate leading to scarcity and wastage at the same time. This leads to delayed recovery, greater loss and hence frustration among impacted people. Moreover because of lack of trust and corruption, full help doesn't reach the needy.

III. PROPOSED SOLUTION

Blockchain can bring the desired trust and authenticity in the whole disaster relief and recovery supply chain. Let's start with a few concepts.

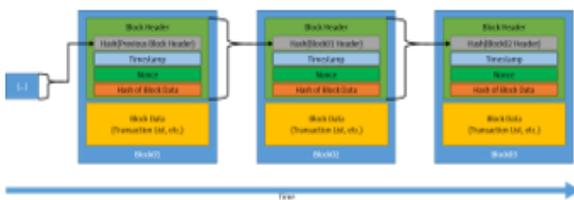


Fig. 4. Source: <https://www.nist.gov/topics/blockchain>.

Blockchain as the name suggests is the chain of blocks where each block contains the hash of the previous block

which is the link in the chain. A malicious user can't modify any block as it will lead to new hash code of this block and hence the next linked block will also require changes. Moreover blockchain works on Peer 2 Peer distributed network which requires consensus among all the participating nodes for making any change to a block. Nodes are the computational devices having the whole blockchain. Thus a malicious user or organisation has to take 51% majority in terms of # of participating nodes to modify the content of all the linked blocks. This is made difficult as to modify a block, one needs to spend around 10 minutes of computational effort. Hence to modify a chain will require a significant amount of time.

Given above, we can assume that blockchain can't be tampered with and is practically immutable. Second property of blockchain is that it's based on the cryptographic public key encryption and digital signatures.

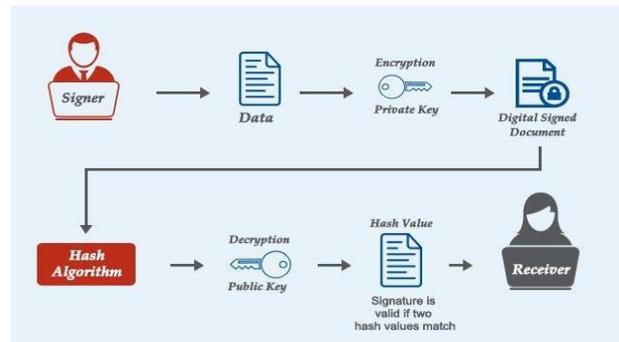


Fig. 5. Sender property.

Sender encrypts the data with its private key. Receiver can use the sender's public key to decrypt this. This proves that data was sent by the sender and hence authenticates the sender. Using digital signatures, blockchain verifies and enforces that blocks are created by the correct senders.

So far one can see that blockchain can eliminate the concerns about trust and corruption from the supply chain. Moreover since the ledger used by blockchain is public, all the transactions can be seen and hence the person donating the money can be ensured that it is reaching the right hands. It's still possible though that some middlemen use the money for their own good and not send it to the desired next person in the chain. Such persons risk legal action but good news is that even this is preventable. To make sure that money reaches end 2 end, we can use smart contract transaction protocol. Smart contract is not some legal contract but a technological obligation enforced by cryptocurrencies. Smart contract makes sure that none of the middlemen receive money until the end person gets the money or services or equivalent resources. This is done by checking the digital signature of the receiver against the smart contract.

With these smart contracts and open transactions all the involved parties could easily track where all the money and resources are flowing. Based on this data, the resource pipeline could easily be adjusted to bring desired resources to needy persons with full authenticity and no wastage.

IV. SMART CONTRACT ESTABLISHMENT

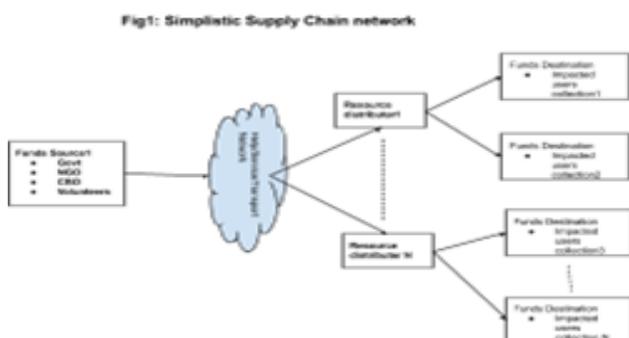


Figure 6. above shows a simplistic supply chain relief network showing the movement of funds between various entities. Smart contract requires source and destination but in this case end users getting the relief can't be used as destination, as most of the cases it's unknown. Thus the resource distributor closest to the end users will be used as the destination while forming the smart contracts. Blockchain will look like following:

Fig2: Blockchain for the smart contract



Fig. 7. Above shows various blocks in the blockchain.

Block data will contain various entities in the chain providing services or transportation. In doing that service fee will get recorded in the block.

This is still not end to end as the end user getting the service is not part of the smart contract. To solve this problem a new app will be required which will have the required authorization to modify the last block in the chain. Behavior of this app will be as follows:

- This app will be installed by the end distributors or service providers.
- On providing the service, the app will require an otp which will be sent on the mobiles belonging to the end users receiving the service.
- End distributor will enter the otp in the app.

- App will validate the otp and hence the money will be released as per the contract between various entities in the chain.

In case end users don't have access to mobile then the service provider will register such users using the app. It will require a user's unique country identification number, for example: social security number (USA) or income tax number or Aadhaar number (India). App will send this number instead of otp for fulfilling the contract. In case users don't have the country unique identification then the user's fingerprint or address could be used.

V. CONCLUSION

Blockchain provides a central tracing and tracking mechanism to make the disaster supply chain trustworthy and efficient. With smart contracts it ensures that money reaches the desired end point. Also a trusted & open system implies more donors, accountability and involvement. Blockchain can't magically heal people impacted by a disaster but it can definitely help in providing needed resources faster, reduces waste, motivates more donors and hence will save lives.

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