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A Digital Framework for CSR Donations using Blockchain for Disaster Victims

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Abstract

This paper proposes the adoption of consortium blockchain technologies as a more efficient and effective means of transferring funds from corporate donors as part of corporate social responsibility to victims of natural disaster. The main benefit envisaged is that post-disaster disruptions to normal lives can be minimized or normal lives can resume better than the current situation as donation mechanism relies largely on manual and centralized processes. Using blockchain, corporations can donate fund anytime and this is especially useful for small and medium enterprises (SMEs) where they can donate in small amounts in a consistent manner to a fund setup for a disaster relief and recovery that disaster victim can use whenever required. The use case for this blockchain is corporate donors donating funds to victims of strong wind disaster in Brunei Darussalam. Through smart contracts of Ethereum, corporations incorporate details of donations and set out other requirements. A Brunei Government's agency use of set of criteria can be used as part of the smart contract terms and conditions. These smart contracts can be part of decentralized applications that can be deployed to the blockchain network using cryptographic mechanisms to ensure security and integrity of the transactions. By this way, more companies are motivated to participate in donations while ensuring that victims can receive much needed assistance in the shortest time possible without solely relying on centralized bureaucratic processes.

Keywords: Disaster Relief and Recovery, Consortium Ethereum Blockchain , CSR Donation and Fundraising

1 Introduction

The efforts for disaster recovery in assisting victims in natural disaster in Brunei Darussalam can be very slow and can affect or interrupt normal lives of the victims. Payments from donors may be slow and may even miss the intended victims who sorely need assistance during the

hours of great needs due to bureaucratic and manual processes. Currently, victims have to rely almost entirely on government funds based on the allocated budgets and this may not be enough to cater to the victims' needs.

This paper explores the possibility of using blockchain technologies to provide more efficient means of raising funds from corporations that can be done anytime and not necessarily during disaster times only. This is especially beneficial to small and medium enterprises (SMEs) who would like to donate to disaster victims as part of their corporate social responsibility (CSR) but was unable to do so due to lack of proper mechanism and likely short of funds during the unfortunate times.

Strong wind disaster is selected as a use case in this study due to its prevalence in recent years and the big traumatic experience and economic losses it can unleash to the victims and the affected communities at large. The fundraising mechanism is through businesses in Brunei Darussalam who wish to donate as part of CSR. This study thus focuses on CSR initiatives in mitigation and preparedness stage of disaster management by providing a digital framework through the use of blockchain so that such funds can be used during disaster relief and recovery in the aftermath of a disaster. Additionally, such fundraising can also be activated should the funds are found to be sufficient by utilizing the smart contract and secured by the consensus properties of blockchain networks such as using byzantine fault tolerant that is useful in network environments where trust of each node in the network is not guaranteed.

Current funding budgets and the associated processes are owned by the government through the Ministry of Finance and Economics which are channeled to the National Disaster Management Centre (NDMC) as well as to JAPEM and other relevant government agencies while CSR funding from the private sector is channeled to JAPEM, the Community Development Department of the Ministry of Culture, Youth and Sports of the country for facilitation purposes only. Big organizations normally put aside a certain portion of their budget as donation for any disaster which they use whenever disaster happens by transferring the funds to the needy using JAPEM's assistance but many smaller organizations may not have such luxury to provide substantial amount as required once a disaster happens since they do not normally set aside such CSR budget for disaster. One of the reasons is that they may not have sufficient cash to donate during disaster times even though they may have the sympathy to donate to the victims.

With the availability of newer distributed computing technologies like blockchain, there exists new opportunities to come up with new CSR initiatives for these smaller companies that aim to lessen the burden faced by disaster victims in Brunei Darussalam. This CSR initiative would have been impractical to implement before the advent of blockchain technologies. Thus, smaller businesses may be able to contribute by donating during non-disaster times when they have the funds to do so. Furthermore, the new participation from SMEs would also potentially relieve bigger organizations from having to pledge donations during disaster times as what are always expected of them as the big organizations in the country and not to mention would remove the over-reliance on government funds for the past decades of disaster incidents. Furthermore, business themselves are exposed to risks of natural disasters and the business owners themselves can become disaster victims and may require financial assistance to get their business operations back.

The study aims to design a new framework for CSR donation for disaster relief for companies in Brunei Darussalam for victims of strong winds disaster. Based on current processes and practices, this proposed digital donation system framework should contain both Business-to-Business or Business-to-Government (B2-B and B2-G respectively) and Business-to-Consumer (B2-C) transactional systems as the companies need to liaise with a government agencies who would also liaise with other agencies or groups like the Army or village heads

and voluntary groups like 4-Wheel-Drive Association to finally ensure the money and other donated necessities reach the intended victims. Apart from companies, in the future philanthropic organizations or wealthy individuals or families would also like to donate voluntarily despite any business relationships. Using blockchain peer-to-peer decentralized computing architecture victims or next-of-kin of victims can directly obtain fund from corporate donors to recover themselves from the economic loss due to disaster and the fund required can be obtained faster.

2 Literature review

2.1 What is Corporate Social Responsibility (CSR)?

CSR is generally defined as an approach adopted voluntarily by corporations and without external regulation by either stakeholders or the state. (Idowu, 2013)

2.2 CSR and Disaster Management

With regard to CSR activities in the field of disaster management, the tendency is that they focus primarily on response and recovery activities than mitigation and preparedness. (Miyaguchi & Shaw, 2019) To date, there has been very little private sector involvement in natural disaster reduction in the form of CSR initiatives. (Miyaguchi & Shaw, 2013)

Response and recovery activities include such as rescuing people, providing immediate needs, coordinating relief efforts for sanitation and health, providing infrastructure repair, financial contribution, etc. But for disaster management, mitigation and preparedness activities have not been featured in the discussion about CSR.

2.3 What is Blockchain and its relevance to disaster management?

The unpredictability of disaster occurrences such as strong wind phenomena in Brunei Darussalam in recent years, and the speed and scale of destruction which it can unleash, require tremendous efforts in disaster response and recovery that are normally well beyond the resource capacity of the victims, the community and sometimes even the state. The hope of alleviating the worst possible scenario rests on the ability to implement initiatives that can improve disaster preparedness and mitigation.

Blockchain technology represents such hope as it can enable collection of fund from donors and disbursement of such donation to the recipients i.e. the disaster victims in an efficient and secure manner. The blockchain concepts were first introduced by the creator(s) of BitCoin, the first crypto-currency that is still the most popular one in the world, and was described by Nakamoto, the pseudo-name of the creator(s), as a peer-to-peer electronic cash system. (Nakamoto, 2009) Donors and recipients can be connected securely without central authorities like banks even if there is no trust established between them. This disintermediation can save time and money as middlemen and intermediaries and bureaucratic processes can be sources of delay.

The definitions of blockchain can also be explained in terms of the versions as shown in Table 1 below. Currently, Blockchain 3.0 is emerging as blockchain usage has started to permeate other fields of human endeavour. This paper is thus an attempt to apply to both Blockchain 2.0 and Blockchain 3.0 in producing smart contracts in donation and decentralized applications in disaster recovery respectively.

Table 1

Definitions of the different versions of blockchain (Mohsin et al,2019)

Definition	
Version	
Blockchain 1.0	Corresponds with the original cryptocurrency uses.
Blockchain 2.0	Introduced in January 2014 with the launch of the Ethereum platform as an open-source platform which enhances smart contracts and focuses on financial transactions such as loans, stocks and financial contracts.
Blockchain 3.0	Introduced to cover a range of non-financial transactions such as usage in health, art, science and government

Blockchain networks can be further categorized according to the network's management and permissions whether they are public, private or federated (consortium). Public blockchains allow anyone to join as a new user or node miner and anyone can make transactions, create contracts and so on. In private blockchains however; which along with the federated (consortium) belong to the permissioned blockchain category, usually, a whitelist of allowed users is defined with particular characteristics and permissions over the network operations. (Casino, Dasaklisb & Patsakisa, 2019)

Private and consortium blockchain networks can avoid expensive Proof-of-Work (PoW) mechanisms by using consensus protocols based on disincentives. (Casino, Dasaklisb & Patsakisa, 2019) The main difference between consortium blockchain and private blockchain is that in consortium blockchain, a set of nodes, named leader nodes, is selected instead of a single entity to verify the transaction processes. (Casino, Dasaklisb & Patsakisa, 2019) This enables a partially decentralised design where leader nodes can grant permissions to other users (Casino, Dasaklisb & Patsakisa, 2019) and as such consortium blockchain is considered a combination of public and private blockchains. The summary of the difference between the three blockchain networks is shown in Table 2 below.

Table 2

Classification and main characteristics of blockchain networks. (Casino, Dasaklisb & Patsakisa, 2019)

Property	Public	Private	Federated (Consortium)
Consensus	Costly PoW	Light PoW Centralised	Light PoW
Mechanism	All miners (Pseudo)	organisation	Leader node set
Identity	Anonymous	Identified users	Identified users
Anonymity	Malicious?	Trusted	Trusted
Protocol Efficiency & Consumption	Low efficiency, High energy	High efficiency, Low energy	High efficiency, Low energy
Immutability	Almost impossible	Collusion attacks	Collusion attacks

		Centralised	Semi-Centralised
Ownership & Management	Public Permissionless	Permissioned whitelist	Permissioned nodes
Transaction Approval	Order of minutes	Order of milliseconds	Order of millisecond

As the topic of interests in this study is to create a consortium blockchain for CSR donation for businesses or corporations, three technologies stand out in the field of enterprise blockchain technology: Hyperledger Fabric, Ethereum and IOTA. Which one is the best for enterprise? Note that IOTA is not a blockchain as it relies on a directed acyclic graph (tangle) which attempts to correct inefficiencies of the current blockchain protocols. (Mueller, 2018) IOTA which stands for internet of things association focuses on machine-to-machine (M2M) interactions and transactions without human intervention. Hyperledger Fabric on the other hand, is an open source project led by The Linux Foundation with more than 260 members and helped by IBM engaging in enterprise blockchain and distributed ledger technologies (Ferris, 2019). As stated by its founder, Buterin Vitalik in the white paper, Ethereum is a blockchain with a built-in fully fledged Turing-complete programming language that can be used to create "contracts" that can be used to encode arbitrary state transition functions. The Fig. 1 below shows a criteria being used to compare among the three platforms. The comparison covers the following criteria (Mueller, 2018) with the idea of smart contracts and tokenization on top of this study's focus:

Table 2

Schematic representation of the differences between the systems. (Mueller, 2018)

Property	Hyperledger	Ethereum	IOTA
Capability of handling the decentralised data storage	Data is distributed and stored by all members of the private hyperledger consortium. Decentralization is limited to the attending members.	Ethereum provides all functions for true decentralized applications.	The protocol currently implemented is neither decentralized nor trusting, as it uses a number of central components to maintain its functionality.

Degree of data security and privacy support	Private transactions are possible – the trust in the system is limited to the trust in the owner of the blockchain.	Ethereum offers a less range of enterprise and data privacy functions than Hyperledger Fabric. Framework like evan.network or Quorum close this gap.	Until now IOTA included a few measures for data privacy. The announced “Masked Authenticated Messaging” should bring relief but it is not available yet.
Possibility to support tokenization for digital business models	No support to classical tokenization – you can build a tokenlike construct	Tokenization is one of the biggest strengths of Ethereum. It is an integral part	IOTA was designed to enable an efficient exchange of data between machines

Extend in which smart contracts are supported

Ensuring the immutability of data but it's limited to the specific use case.

Smart contracts (Chaincode) runs inside a docker container. This is very fast but hard to handle and nondeterministic approach – what is important to know.

All distributed ledger systems ensure that the data cannot be changed. Persistency is easily achievable.

of the Ethereum and therefore
core. tokenization of
values is not part
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of the platform.

Smart Contracts	Smart Contracts	b	u
are integrated	are not currently	y	m
into the core	supported by	a	V
architecture at	IOTA.	l	i
Ethereum		l	r
and		n	t
		o	u
		d	a
In private	Currently there is	e	l
chains you will	no possibility of	s	M
mostly have a	permanent and	w	a
kind of central	unchangeable	i	c
authority but	storage of data.	t	h
Ethereum give	Basically the	h	i
you everything	architecture of	i	n
you need to	IOTA is not	n	e
build truly	designed for the	t	(
decentralized	permanent storage	h	E
consortium	of data.	e	V
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2.4 Smart Contract

First introduced by Nick Szabo in 1996, the basic idea of smart contracts is that many kinds of contractual clauses (such as liens, bonding, delineation of property rights, etc.) can be embedded in the hardware and software. (Szabo, 1996) After the launch of bitcoin as the first decentralized application of blockchain in 2009, the concept was incorporated into Ethereum and as mentioned above ushered a new era of blockchain 2.0 (see Table 1 above). Using this capability of the in-built programming language, Solidity, in Ethereum which compiles in Ethereum Virtual Machine or EVM, details of a contract can be added to a block and secured with cryptography. Such capability will be useful for creating semi-decentralized applications for CSR donations to disaster victims.

2.5 Tokenization

Another concept that is useful is tokenization which was also incorporated into Ethereum when it was first launched. The criteria, “possibility to support tokenization for digital business models” as shown in Figure 1 above is not readily available for Hyperledger Fabric but it can be done indirectly while IOTA is not designed to provide tokenization.

3 Methodology

3.1 Interviews

An interview was conducted with the Head of Disaster Unit and Housing Assistance of the Community Development Department (JAPEM) of the Ministry of Culture, Youth and Sports, Awang Mohd Johardi bin Hamdi at his office. Excerpts of the interview are as follows:

Question: Does JAPEM provide assistance to natural disaster victims?

Answer: Yes, we look after the welfare of victims of natural disaster. Only for citizens and there are criteria for this too. For financial assistance the procedures are as follows:

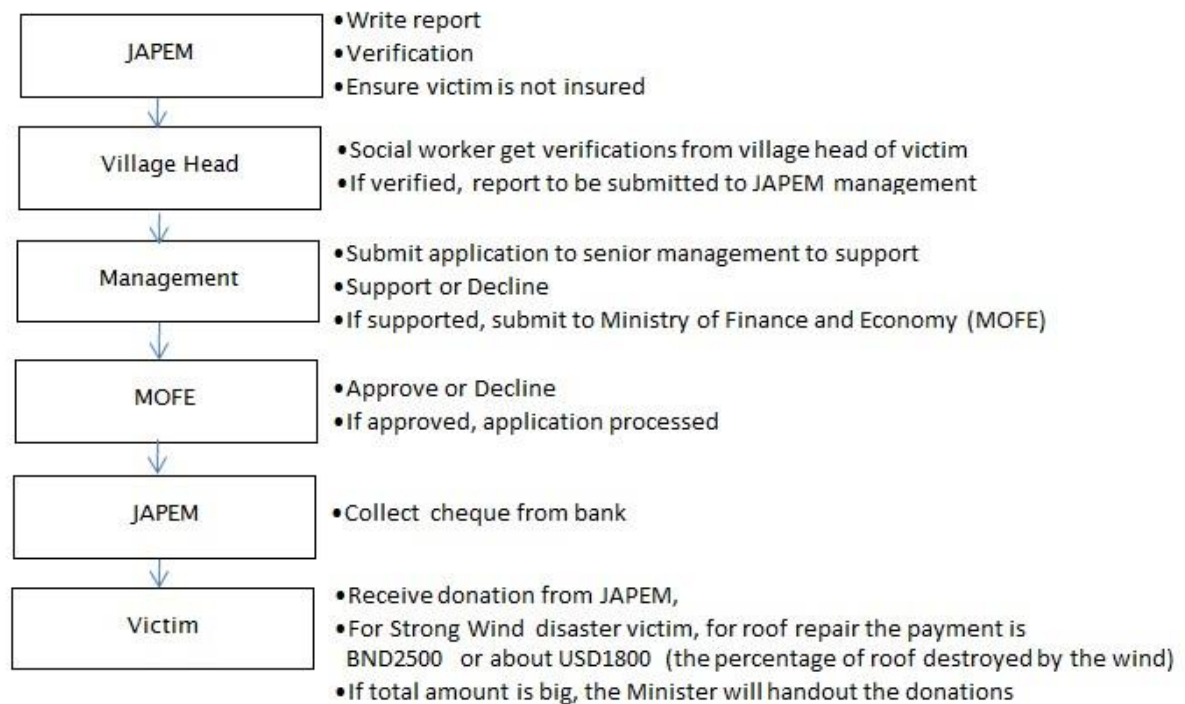


Figure 1

Current procedures of receiving funds from the government and handover to the victim.

Question: Does JAPEM provide other assistance to disaster victims besides money? Answer: Yes, we provide financial assistance, basic necessities (food and other necessities like toiletries, towels etc) and temporary accommodation.

Question: Sources of disaster fund?

Answer: From government only where all the funds are held by MOFE. Funds are not from the public and we do not accept money from the public (Our Disaster Unit of JAPEM only facilitates like providing list of victims for public to donate directly or they can borrow our facility for food and other basic necessities donation and to donate directly to victims (case by case)).

Question: Is JAPEM the central national authority for distributing funds to disaster victims or intermediaries like head village?

Answer: JAPEM only distributes funds to victims based on the certification/approval/report after claim made from MOFE and approved accordingly.

Question: How does JAPEM get the news of disaster?

Answer: Fire and Rescue Department report to our Disaster Unit at JAPEM hotline.

Question: Do businesses donate sufficiently? Answer:

Not so much, only big companies.

An interview with a victim of strong wind disaster was also made and he revealed that he received donations of financial and basic necessities about three weeks after the disaster in a handover ceremony by the Minister where other victims of different natural disaster and incidents like fire were also attending.

There are no inconsistencies in the time that a fund can be handed out. According to the Minister however in a news report in Radio Television Brunei that “on the assistance provided by the government to disaster victims, in 2018, 637 people comprising fire, flood, strong winds, landslides and collapsed houses victims received a total assistance of nearly 350 thousand (Brunei) dollars. The Ministry's Client Charter or TPOR is to distribute financial assistance for a period of not exceeding 2 months. (RTB News, 2019)

3.2 Content analysis on donation news in the media

The primary source is the JAPEM website and also local news from Borneo Bulletin on the internet, government-owned official newspaper Pelita Brunei and the news archive from the state television, Radio Television Brunei websites

4 Rationale

The study identifies gaps arising from the literature review, interviews and the related content analysis of the media as follows;

- Time to receive donation after a strong wind disaster.
- No donation system for companies' CSR initiative apart from the voluntary services provided by JAPEM such as in providing victims' lists and details.
- With current situation, donors would not have transparency that the money donated is used wisely or directly to assist the victims in times of great needs.
- More funds can be collected if the right donation mechanism is in place.
- Companies CSR activities during disaster preparedness stage and mitigation stage are lacking since they will only donate for disaster recovery or relief.

5 How the gaps can be addressed using blockchain.

A new blockchain-based platform for CSR donations to strong winds disaster victims will be most suitable to address the lack of donation drive from companies especially from SMEs in Brunei Darussalam.

How does blockchain fit for the purpose of this use case? A useful model aptly named FITS which stands for Fraud, Intermediaries, Throughput and Stable Data can be used to ascertain its suitability. (McCullagh, 2017) Disaster relief donation is an area where there are potential for frauds for example a non-victim may claim to be a victim and try to receive a donation. The disaster relief also involves intermediaries in the processes of fundraising from donors and the dissemination of the funds to the victims. Throughput entails the number of transactions per second and blockchain provides better throughput than current mostly manual and centralized transactions of disaster relief operations. Lastly stable data are applicable to the disaster relief use case which relates to the personal profile of victims and donors.

The consortium (federated) blockchain is chosen since it is a combination of private and public blockchain which can be designed as a B2B and B2C transaction system. Ethereum blockchain is chosen over Hyperledger Fabric and IOTA as the preferred enterprise blockchain due to availability of beneficial blockchain features such as the use of irrevocable and immutable ledger records for transparency and auditing purpose as well as the availability of facilities for writing and deploying smart records using a Turing-complete programming language. Furthermore, the availability of tokens and facilities for tokenization will enable the creation of digital assets that can be useful as part of the donation system to launch CSR initiatives.

The following will outline how the specific gaps can be addressed:

5.1 Time to receive donation after a strong wind disaster.

The consortium blockchain technologies can dramatically shorten the approval time for donations from days to the order of millisecond and the receiving of donation assistance can be done immediately. The proposed blockchain system in this study would enable a victim to approach a business or commercial entity that provides services required such as shown in Figure 2 below:

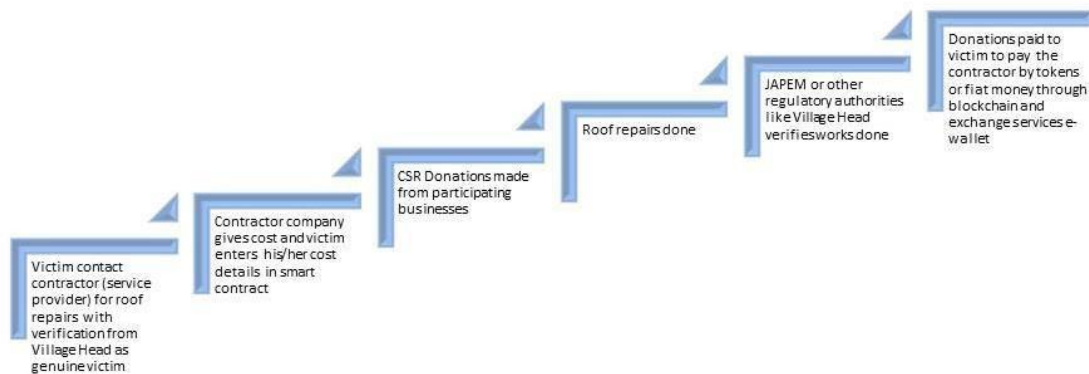


Figure 2

Proposed flows of receiving funds from businesses and handover to victim.

5.2 No donation system for companies' CSR initiative apart from the voluntary services provided by JAPEM such as in providing victims' lists and details.

Companies who pledge to donate to the strong winds victims fund form a consortium and agree on criteria which can be based on JAPEM's template which can be part of the smart contracts to be deployed on the consortium (federated) blockchain by using an Ethereum a DApp or decentralized application that can be developed. When a disaster happens, victims' lists and details will be entered to the system by using the oracles facilities like oraclize. Details of the smart contract or the oracles that added to a block are secured with cryptography for all participants.

5.3 Donors have no satisfaction or transparency that the money donated is used directly to assist the victims.

JAPEM's criteria for funding strong wind disaster victim's requirement can be used to avoid excessive or unethical demand by the victims which may be used by the validators of the contract or new criteria can be established with the study of typical victims' needs as a result of the disaster. The availability of information from various parties and which are validated by the validators who are selected to validate the transactions will ensure true transparency. The smart contract can decline any request for funds should the criteria are not met as set out in the smart contract.

5.4 More funds can be collected if the right donation mechanism is in place and companies CSR activities during disaster preparedness stage and mitigation stage are lacking since they will only donate for disaster recovery or relief.

By utilizing blockchain tokenization and e-wallet facilities, companies can plan their financial budget for CSR donation in a more effective way since more or fewer funds can be added to their e-wallet in relation to the ups and downs of businesses to the e-wallets during the non-disaster periods. Tokenization also enables companies to create digital assets by using tokens based on the physical assets that they own. The participation of more businesses in the consortium thus increases the overall funds as time goes by. The victim may require the fund to immediately pay the business as in Fig. 3 above can be in the form acceptable to the contractor of the roof such as fiat money or cash or tokens or digital assets such as cryptocurrency or Ether, which is available in the ethereum public blockchain eco-system.

6. Digital framework for CSR donation using blockchain

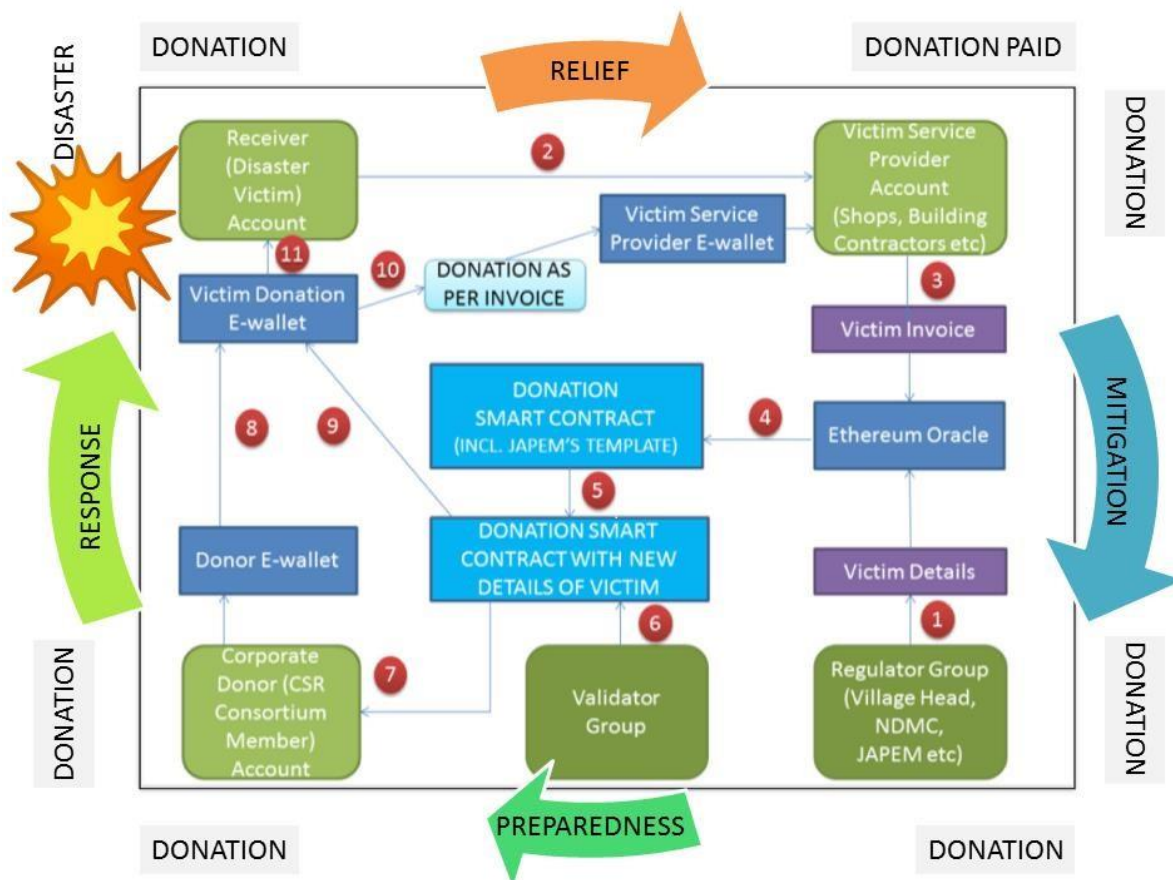


Figure 3

Digital framework for CSR donations using blockchain for disaster victims

The above digital framework provides the high-level view of the main processes which can be explained as follows (Numbers refer to Numbers in Circles in Figure 3):

- 1) Regulator Group (Village Head) enters victim details into Ethereum oracle
- 2) Disaster Victim goes to Service Provider for buying necessities.
- 3) Service Provider identifies victim from Regulator Group so submit invoice to Ethereum Oracle.
- 4) Ethereum Oracle enters detail to Donation Smart Contract.
- 5) New details of victim appear in Donation Smart Contract.
- 6) Validator Group validate transactions
- 7) Victim Details and Invoice of buying necessities appear to Corporate Donors who are CSR consortium in the blockchain to respond for donation
- 8) Corporate Donor send donations to Victim E-Wallet
- 9) Donation Smart Contract deducts invoice amount from Victim E-Wallet
- 10) Smart Contract sends donation deducted from Victim E-Wallet to the service provider as per invoice. Payments can be by tokens or cash.
- 11) Donors who send extra funds or have been donating even during non-disaster time by placing funds in their e-wallet can send the donations to be accessed by the victim.

7. Discussions and Conclusion

The paper proposes a blockchain-based digital framework for enabling more participants from the business community in donation event as part of their corporate social responsibility. The corporate donors especially SMEs can now enjoy the flexibility of donating whenever they like as they have credits in their e-wallets to donate even their companies at the time of disaster have insufficient financial resources. Technically a computerized non-blockchain type of fundraising platform is possible but one of the main motivation of this proposed platform that is to increase participation of CSR especially among SMEs will not be possible without the cryptographic features of blockchain that ensures transparency and trusts. Without blockchain, how can it be ascertained that the money will go to the intended victims? The quickness of donation may not be an issue but the integrity of the processes will not be guaranteed. Table 3 below will compare the various currently available blockchain-based social and charitable donation platforms with the proposed platform framework and it can be seen that one main innovative feature is really unique whereby the victim can go to any service providers during disaster relief to initiate recovery of broken assets or other requirements such as in getting food or medications and that this will be instantly paid by the CSR donors through the blockchain either through fiat money, ethereum own cryptocurrency, ether or tokens of digital assets through exchange of value processes .

Table 3

Comparison of proposed framework to currently available blockchain-based social

Platform	Innovative features	and charitable donation platforms.	• Ease of donating • Transparency Blockchain network/ Smart contract
CSR Donation for strong winds victims	<ul style="list-style-type: none"> • Corporation donates anytime and tracks donations • Victims go to service providers for relief and paid instantly by donors through tokenization of digital assets or normal fiat money. Earlier village heads enter details into smart contract. 	<p>Main Motivation</p> <ul style="list-style-type: none"> • To encourage more CSR donations anytime, not just during disasters. • Victims get donations instantly as needed by going to service providers all as part of network. • transparency in donation to increase participation 	<p>Consortium Ethereum blockchain with smart contract incorporation of JAPEM's criteria for victims to avoid fraud includes such details like estimated donation amount for claims or otherwise rejects claim.</p>
Alice (Krypto Graphe, 2019)	Freezes donations until charities are able to prove that they've achieved their donation goals.	To encourage more people to donate to charities while it ensures transparency.	Public Ethereum blockchain Tracks donations and ensures impact as proposed or otherwise cancels and return money to donors. Public Ethereum blockchain
Pinkcoin (Krypto Graphe, 2019)	Uses own cryptocurrency to make donation easy and also rewards users through unique staking technologies.	To encourage more people to donate to charities while it ensures transparency	<ul style="list-style-type: none"> • Receive interest and get profit for holding coins in wallet • Algorithm randomly selects someone who will receive a reward.
GiveTrack (Kryptomeans, 2019)	Use of bitcoin as the means of donating to charity.		No smart contract

The new blockchain-based platform for CSR donations to strong winds disaster victims will be most suitable to address the lack of donation drive from companies especially from SMEs in Brunei Darussalam. Of course, strong wind victims are just a use case for this exercise but this can be extended to other victims of

natural disaster. From earlier studies in CSR in disaster management and also confirmed in Brunei case by JAPEM official, there has been very little private sector involvement in natural disaster reduction in the form of CSR initiatives so the proposed framework and its implementation can greatly address this issue. The consortium (federated) blockchain is best suited as it enables any victim and any service provider to join the permissionless network while limiting the participation of business donors only through a permissioned network since the purpose is to increase CSR donation.

Ethereum blockchain is chosen over Hyperledger Fabric and IOTA as the preferred enterprise blockchain due to availability of beneficial blockchain features such as the use of irrevocable and immutable ledger records for transparency and auditing purpose that can be further enhanced with the availability of facilities for writing and deploying smart records through the design of DApps (decentralized applications) using a Turing-complete programming language. The creation of DApps and along with its intrinsic tokenization feature will enable the creation of digital assets that can be useful as not only as part of the donation system to launch CSR initiatives but also towards digitization of the business processes that can eliminate potential bottlenecks. Furthermore, business continuity is safeguarded including during disaster itself since the decentralizations of processes in the blockchain and the cryptographic security mechanism can eliminate single point of failures commonly encountered by centralized systems.

The digital framework is designed such that time to receive donations are dramatically reduced to almost in-demand mode since the needs of the victims are used as the starting perspectives rather than the perspective of bureaucratic and centralized processes. The blockchain network also enables CSR-link funds to be raised even during non-disaster times and this facilitates wider participation of donors especially from the SMEs by utilizing the use of eWallets and other digital features of the blockchain to easily add or transfer funds.

With years of experience in handling disaster recovery and relief efforts for the welfare of the victims, JAPEM's template can be used for writing the details of the smart contracts to be deployed on the consortium blockchain set up by the participating companies which pledge to donate to the victims fund along with participating service providers during disaster such as roofing contractors and car workshop owners. When a disaster happens, victims' lists and details will be entered to the system smart contracts to enable verification by regulators' group such as village heads, JAPEM or NDMC and the transfer of funds can be initiated. Any issue regarding security of the records is covered by the consensus algorithm.

With the availability of Turing-complete language called Solidity in Ethereum, unrealistic demands by victims or even in collusion with the service provider can be avoided by incorporating JAPEM's years of experience as criteria in the smart contract. New criteria can be established with the study of typical victims' needs as a result of the disaster. This is an important component of the framework as it can ensure that victims, service providers and donors are all engaged in ethical transactions and relationships and avoid actions that may demotivate the donors to donate or the service providers to provide the right level of services. With blockchain features, the transparencies of all transactions are there for all participants to see and the hiding of information to cover up fake details is futile since the decentralized ledger records are irrevocable and immutable. The availability of regulator and validator groups in the consortium network will further ensure good governance of the CSR donation system and the smart contract can be used to automatically decline any request for funds should the set criteria are not met.

Better budgetary control for CSR donations can be made by companies especially the

SMEs since Ethereum blockchain features like tokenization and e-wallet facilities can enable companies to add fund to their eWallet or to setup relief fund for disaster victims or funds for disaster mitigation and prevention. SMEs for example can add more funds during favourable business conditions and can use the fund for donations even during turbulent business times that coincides with a natural disaster event such as disastrous strong winds. This ensures better participation of companies and especially SMEs in donation for disaster victims and more funds can be collected than ever before since the systematic processes that are transparent and tamper-proof are in place.

The study thus come up with a viable and innovative CSR donation framework based on a consortium blockchain that if implemented, can assist the victim of strong winds disaster as a use case here to benefit by receiving immediate funds required in the recovery of assets destroyed by the disaster or simply to obtain basic necessities in the immediate aftermath of a disaster through payment to service providers via exchange of value processes such as through tokens, ceypotocurrencies or fiat money. The chosen Ethereum blockchain is found to offer the most features that fit the requirement of the donation platform for the selected use case.

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