

Article

A Study on the Sustainable Development of NPOs with Blockchain Technology

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Abstract: This study investigated the application of a blockchain for promoting the sustainable development of non-profit organizations (NPOs). Transparency and good governance are important for operating NPOs in addition to building trust with relevant stakeholders. NPOs consume a large amount of resources (including funds) to monitor their operations and present their transparency and soundness of governance to interested stakeholders. Blockchain technology can fulfill an NPO's requirements at a lower cost and with a higher efficiency. We reviewed the existing research on NPO governance and blockchain applications. In addition, through case studies, we identified sustainable development strategies for NPOs involving blockchain technologies to increase donation, reduce cost, enhance transparency, and improve governance structure.

Keywords: blockchain; non-profit; transparency; governance; donation; NPO; sustainable development

1. Introduction

Transparency and governance are frequently researched topics in the context of non-profit organizations (NPOs). Disclosing business-related information has been emphasized for the transparent operation of NPOs; nevertheless, it uses a lot of time and resources. While transparency itself is not the core work of an NPO, it is a complex issue because an NPO's work involves pursuing abstract values, such as social innovation. Thus, the efficient management of the time and costs expended in ensuring transparency can determine the success of NPOs. In addition, many studies have shown that disclosing operational information and establishing transparency and good governance are crucial in NPO management. A blockchain's decentralized ledger structure and smart contract can meet NPOs' needs for efficiently sharing information and building autonomous governance.

A blockchain is a system where data are created, managed, stored, and traded through encryption without involving a centralized server. Blockchain technology improves the transparency of information by distributing its storage, and it prevents the manipulation of information by making it impossible to make any changes to the existing stored information. It also reduces processing costs because no intermediaries are needed. Thus, there have been various attempts to enhance existing businesses using blockchain technology. Cryptocurrency, the networked digital cash derived from a blockchain, has induced participation in the blockchain network operation process, thus reducing the costs involved in transferring, storing, and trading value by delivering electronic value through the network.

The use of a blockchain has been examined in regard to NPOs. In particular, focus has been on the use cases of blockchain technology that improve the transparency and reliability of information sharing processes through distributed ledgers. Most blockchain projects in NPOs are in the early stages, and, hence, it is currently difficult to find successful cases. However, we can evaluate diverse attempts in this regard.

Based on existing literature and case studies, we were able to identify the following about the reasons for and the manner in which NPOs have applied blockchains.

First, the utilization of blockchains in NPOs has resulted in increased donations by enhancing the transparency and operational efficiency of the donation platform.

Second, a smart contract on a blockchain, which facilitates, validates, and digitizes the performance and negotiation of the contract, has been used by NPOs to automate, streamline, and reduce costs.

2. Existing Research

Before discussing NPO blockchain use cases, we review the existing research on governance in NPOs, the characteristics of a blockchain, and the utilization of blockchains in governance. The disclosure of information (including financials) is important and closely related to governance and donation processes. Autonomous and horizontal governance encourages sound operations in an NPO. Distributed ledgers and smart contracts, which are the main characteristics of a blockchain, fulfill an NPO's need for transparency and good governance. We identified studies and use cases of applying blockchain technology in NPOs.

2.1. NPO's Transparency and Governance Structure

Research on NPOs has continuously involved the study of transparency and governance structures. To be effective, NPOs should ensure financial transparency and the disclosure of relevant information, along with autonomous governance design—all of which are important for sustainable development. The transparency and openness of NPOs help in building trust, subsequently encouraging donations. A self-regulated governance system is important for sustainable development [1].

Governance is associated with the distribution of the rights and responsibilities among the various stakeholders, as well as their accountability to each other. The availability and use of information about organizational operations for internal and external stakeholders would provide insights for implementing accountability frameworks and control systems. If governance is poor, it could undermine confidence and reduce donations and activities [2].

Studies have stressed on the importance of the transparent operation and openness of NPOs, but many NPOs have failed to recognize this need. Like governments and corporates, an NPO should ensure timely and reliable information for monitoring by stakeholders. This is one of the key requirements of good governance [3].

The sharing of processes and objectives, as well as financial information, is important for transparency. Nevertheless, divulging NPO assessments may seem risky, as negative assessments may make one vulnerable to criticism from various sources. However, extensive and effective communication with the world can enhance the transparency of an NPO and lead to effective interaction with stakeholders [4].

Governance practices and disclosure by not-for-profit organizations affect donor decisions. Trust in NPOs is an important factor in facilitating donations and is influenced by NPOs' sincerity and transparency. As transparency directly affects an individual's willingness to donate, an NPO should strive to increase the degree of transparency recognized by the donor [5].

A statistical analysis revealed that the extent of disclosure of information is significantly related to the size of donation. The study emphasized that information disclosure reduces information asymmetry among stakeholders and enhances an NPO's accountability and transparency to stakeholders. Thus, disclosing more financial information could make the donors more comfortable towards donation [6].

Strengthening regulations and systems increases the transparency of NPO operations. However, an NPO's autonomy is maintained, and governance structures under social surveillance are also emphasized. Governance structures should be established through the separation of quasi-independent supervision and authority, rather than through vertical monitoring, and they should be strengthened horizontally through supervision [7].

With the ability of market participants to relatively assess performance, transparency can be enhanced and governance can be improved [8]. Governance through autonomous regulations can enhance NPOs' sense of responsibility and increase their understanding of accepted practices, thereby developing norms and standards that did not previously exist [9].

2.2. Blockchain and Transparency/Governance

The blockchain was named in accordance with its basic principle of storing transaction records in units called blocks and linking these and other data blocks to form chains. Instead of being recorded on a central server, the process of creating, managing, and storing information is distributed and stored among various participants in an encrypted form. Transaction records are linked and stored together in an identified order.

Bitcoin is the first decentralized cryptocurrency. It was invented in 2008 by Satoshi Nakamoto, who published "Bitcoin: A peer-to-Peer Electronic Cash System." The purpose of this public transaction ledger was to solve the double-spending problem through the proof-of-work confirmation algorithm, which would eliminate the need for financial intermediaries. To publicly operate a blockchain system, networks offer an economic incentive, bitcoin, to participants during the confirmation process. A crypto token is used for economic value transfer and economic incentives, and it provides transaction convenience, as Satoshi intended [10].

The distributed ledger, a feature of blockchains, got attention due to its benefits of transparency and immutability. Most existing systems were managed by a central administrator through an internet infrastructure and were hence exposed to hacking and data manipulation. However, in blockchain, random data changes are not possible because all participants who share the same network share data individually [11]. The blockchain's decentralized principle provides unique encrypted signatures through peer-to-peer (P2P) networks to ensure reliability and integrity. If someone makes changes on a blockchain to manipulate information, they must also succeed in changing all of the previous blocks stored on about 10,000 nodes globally within the limited time that a new block is created. Since this is practically impossible in the current technological environment, the records stored on blockchains are at a very low risk of tampering, which implies that the information stored on blockchains has an immutable feature [12]. This decentralized ledger system can reduce credit risk without intermediaries, thereby eliminating the costs incurred by brokers. The loss of intermediate and monetary connections also accelerates trading speed [13,14].

Transactional awareness, similar to that in the existing system, has been provided to users on a blockchain to recognize the other party through a public and a private key, enabling the completion of transactions through simple digital signatures; thus, the use of a private key enables participants to distinguish and manage users at a low cost [15–17]. A blockchain itself cannot substitute trust, but it can add value to building up trust by eliminating the dependency on intermediaries and thus reducing cost. A blockchain merely converts trust from one form to another, whereby the previous trust between people and institutes is altered to trust in technology. On a foundation of mistrust, a blockchain shows how technology can support the building a network of trust [18].

Blockchains are rapidly expanding their use due to their features, such as transparency, immutability, and economic efficiency. The Center for Social Innovation in Stanford graduate school of business surveyed 193 organizations and their projects related to blockchains in 2017. It was found that only 34% of the newly launched institutions, organizations, and projects used blockchain technology in 2017. Though 73% of them were found to be in the experimental stage or were indirectly affected by a blockchain, 55% were forecast to be directly affected by blockchain technology in 2019 [19].

The use of blockchains in enhancing governance has been studied in the context of the corporate sector. Studies have reported each area that could affect corporate governance under the blockchain framework. Low cost, more accurate record management, and the transparency of ownership through blockchain influences corporate governance. A transparent system can significantly improve the balance

of power among individual interest groups within a firm. The more a company uses a blockchain, the less its current auditing function will be [20].

Strengthening transparency in stock ownership in corporate governance will also enable small investors to see changes, thereby boosting transactions and enhancing the profitability of stocks. Blockchain systems can monitor insider trading to reduce negative impact on start-up companies and to track additional processes, such as holding shares as collateral or creating derivatives from them, enabling a company to monitor the indirect activities affecting a company's operations [21].

Even during corporate elections, incorrect lists of voters due to changes in shareholder lists and incomplete progress in voting are problems. However, a blockchain allows voters with voting rights to proceed based on whether they receive a token to vote, and the blockchain transmits it in real time, thus reflecting fast, transparent, and accurate opinions.

Another example of strengthening an organization's governance structure is real-time accounting. If a company uses a token as the medium of exchange, transactions can be reflected in its accounting in real time and lead to the disappearance of intermediary financial institutions, thereby saving money. It can also reduce moral hazard and principal-agent problems, and it can monitor real-time inter-agency transactions.

The three elements for building trust are identity (identification), ownership, and verification, which can be implemented through a blockchain. A blockchain allows users to prove their identity, protect ownership of digital assets, and confirm transactions without relying on intermediaries. A blockchain's digital signature enables identification without having to go through a complicated process. The data permanence of a blockchain allows ownership to be acknowledged by giving credibility to historical ownership record data without the need for proof through third-party intermediaries [19].

This process addresses the verification issue through a shared and distributed consensus process for everyone in the system without the relay or the authorized agency. In a survey on blockchain benefits, more than 38% of the participants answered that reducing risk and boosting morale were the primary benefits of a blockchain. In other words, a blockchain is recognized as the most effective benefit of confidence building.

2.3. Blockchain Utilization for Building Sound Governance

Due to the advantages of blockchains, many academic and practical attempts have been made to utilize blockchains in NPOs. NPOs use blockchain technology to make operational processes more efficient and transparent.

An advantage of a blockchain is that users who share a network can verify transactions in real time, which can increase the transparency of NPOs. Thus, it is possible to accurately track and monitor donations and the utilization of funds. The immutability feature, wherein none of the participants can change data without permission from all who share the network, is being used by NPOs in areas such as voter authentication and land ownership registration in voting [22].

Reducing the risk of the counterparties (and subsequently paying low costs) also lowers the risk posed by low creditworthiness and corrupt intermediaries in overseas NPO projects. In addition, NPOs can more easily and quickly transfer funds when it is difficult to use financial systems. The blockchain's feature of being used as an efficient ID is very helpful in operating NPO projects in regions that do not have an identity management system, such as in Africa [13,19].

By maintaining transaction data on blockchains in the operationalization of contributions, NPOs can eliminate the need for third parties or intermediate managers to broker transactions through a secure distributed ledger, and they can increase the transparency of donation management by distributing information through a blockchain for its participants to manage and operate. When an NPO registers its project on a network, the donor can choose the target of the donation, and all the details of the donation can be recorded in the blockchain. Once a donation reaches the beneficiary's account, the information on transfer and withdrawal is also recorded. The NPO records where, when, how, how much of the donation was spent, and what achievements were made. In this series of

processes, all who share the same network can become monitors and see the transaction process from the beginning to the end [23–25].

In regard to sending contributions to other countries, a blockchain can be used to solve issues such as expensive fees for contributions and delays in transferring contributions. It becomes possible to monitor the flow of funds at all levels within an international aid program, including at a disaster site where it is difficult to deliver funds or in countries where the financial system is not well equipped [26,27].

Cryptocurrencies cannot be overlooked while discussing blockchain technology. As one of the technological and economic potentials of blockchains, they can be considered means of value and used for donation. Cryptocurrencies generated by blockchains basically guarantee anonymity. Many donors do not want to disclose their personal information, which can be protected by donating cryptocurrencies [28,29].

With cryptocurrencies recognized as assets by some governments and benefiting from their donations, transactions in cryptocurrency have gained further momentum and have become established as a donation trend [30,31]. In addition to the benefits to donors, there is a growing demand that donations through cryptocurrencies be tax deducted to better facilitate donations [32].

NPOs can use cryptocurrencies for project design through initial coin offerings (ICOs) and project execution through funding. ICOs not only lead to donations but also offer the advantage of earning returns as an investor in the form of tokens generated by using the blockchain. However, there is a risk of abuse due to a lack of regulations on it. Therefore, national-level discussions and the establishment of technical grounds are needed to foster and implement cryptocurrencies [33].

The utilization of blockchains by NPOs can build trust among donors (including potential donors) by managing NPOs' reputations in the long term. The management of charity projects in a transparent manner, and the creation of a sound NPO ecosystem can be ensured by sharing with donors how their donations are being used. Cryptocurrencies expand the base for donations through a variety of uses, including simple donations.

3. Research Method

This paper identified contextual factors for the sustainable development of NPOs and established research methods based on the existing research on blockchain and its use cases. Through this, we delineated major issues and related propositions on NPOs' transparency and governance, and we established analysis tools. The data collection and analysis were designed based on related literature research, discussions with internal and external experts, interviews with non-profit participants, and case studies.

A multi-case study method was used to derive implications from the detailed case studies and to develop realistic suggestions based on theory [34,35]. This paper consists of individual cases, followed by sections on cross-case analysis and results [36]. A comparative method was employed to interpret the empirical cases [37–39].

We examined the ways to utilize blockchains in NPOs through cases where they are actually being applied based on the aforementioned research framework.

4. Case Study

Table 1 presents the goals, methods, and characteristics of the identified cases.

Blockchain adoption cases for NPO projects were studied and are summarized in Tables 2 and 3. Some NPO projects have adopted blockchain to expand donation size (Table 2) and to enhance the efficiency of business operation (Table 3). The use of blockchains has been recently initiated in non-profit businesses; hence, some cases are in their initial stages such that project performance cannot be proven as of yet.

The case studies analysis focused on projects that used blockchain to expand donations of non-profit businesses and to streamline internal operations.

Among those, BitGive/GiveTrack and AidChain cases were given a closer look in this study. In addition, global projects operated by United Nations International Children’s Fund (UNICEF) and the United Nations World Food Programme (WFP) were examined as the projects that streamline internal operations and strengthen governance.

Table 1. Classification of cases of blockchain utilization in non-profit organizations (NPOs).

Goal	Method	Characteristics
Increase donation	Development of a donation platform	Share real-time data on donations and their use, thereby increasing transparency and ease of use.
	Adoption of cryptocurrency	Convenience, anonymity, and low fees for transfers and donations.
	Expansion of social contribution	Add value to NPOs using blockchains (transforming intangible value, such as volunteer work, into tangible value, and operating annuity for self-help of donor recipients).
Utilization in business operation	Operational efficiency, transparency	Real-time information sharing using distributed ledgers for fund movement, operation, and business management. Smart contracts are automatically executed when conditions are met to prevent intervention and manipulation by brokers.
	Economic efficiency of operation	Decrease financial commission, labor costs, and time spent by not using existing financial networks.

Table 2. Cases of expansion of donations.

Classification	Case Name	Characteristics	Progress and Performance
Donation platform development	Alibaba (Ant Love) [40–42]	Alipay app allows donors to check where NPOs need support in real time and make donations. All processes are logged and shared through a blockchain.	Launched the system in 2016 and applied blockchain technology in 2017 to Ant Love. More than 400 million Alipay users can access charity platform.
Donation platform development/donation through cryptocurrency	BitGive (GiveTrack) [26,43–45]	Allows one to choose from a list of villages on the platform that one would like to help by sending bitcoin to bitcoin addresses owned by GiveTrack. Real-time visibility into project status.	Considered the first system of donating money through Cryptocurrency in the US.
Donation platform development/donation through cryptocurrency	AidChain [46–48]	A donation platform based on the Ethereum blockchain that enables charities, donors, and recipients to track the process of donation and the use of donations through the Transparency Engine application.	Developing a payment portal, AidPay, that can transform cryptocurrency into its own donor coin, AidCoin.
Donation through cryptocurrency	Pineapple fund [49–51]	All participants, as well as the founder of the fund, can donate through cryptocurrency to ensure individual anonymity.	Donated US\$55 million worth of Bitcoin to 60 charities. Ended 11 May 2018.
Donation through cryptocurrency	Greenpeace [52–54]	Partnering with the Bitcoin payment company Bitpay to receive Bitcoin donations and 100% of donations without fees.	Greenpeace operates on private donations for non-profit purposes, rather than accepting donations from businesses or the government. Collects steady bitcoin donations in a transparent manner.
Compensation and donation for social contribution activities	IXO Foundation [55,56]	Tokenized the social impact of philanthropy—once confirmed, tokens are given, which can be used for future donations.	Records children’s participation in education in South Africa and issues a token. In addition, the platform is used for various philanthropic activities in developing countries.

Table 3. Cases of Utilization in Business Operations.

Classification	Case Name	Characteristics	Progress and Performance
Increased operational transparency/convenience	United Nations International Children’s Fund (UNICEF) smart contract [50,57–59]	Using smart contracts, deals are programmed to be executed automatically when conditions are met. Transactions through blockchain provide transparency.	Investment, technology development to implement smart contracts through UNICEF Ventures. Transparency is greatly enhanced by all information, activities, and the disclosure of transactions.
Increased operational transparency/convenience/reduced operating costs	Disberse [60–63]	A fund management platform using a blockchain, which drives efficient and transparent flow and delivery aid. Each stakeholder can track funds from donors to beneficiaries.	Reduces the commission of contributions remitted for education projects in Swaziland by 2.5%. Support three students for an annual tuition with the saved fee.
Reduced operating costs	United Nations World Food Programme (WFP) [64–71]	Utilizes Ethereum blockchain technology for refugee aid. Significantly reduces financial fees, labor costs, and time spent.	In May 2017, it delivered food e-coupons worth US\$1.4 million to about 10,000 Syrian refugees in Jordan. E-coupon transactions were recorded in the blockchain.

4.1. BitGive

BitGive focuses on philanthropic projects in the environment and public health sectors, and it hosted the first “donation project through Bitcoin” in the U.S. in 2013. Most of the projects are being carried out globally, including the construction of toilets in Kenyan schools and the support of mobile devices needed for Nepal’s medical service. GiveTrack is a blockchain-based donation platform created in 2016 by BitGive. As GiveTrack has carried out international business in Chile, Ethiopia, Afghanistan, Venezuela, Argentina, Ukraine, and the United States, it has dealt with the limitations of the existing financial system, including high costs.

BitGive opened the GiveTrack platform using blockchain for charity, allowing users to share their use. GiveTrack seeks to address issues such as limited financial services, transaction and service fees, a lack of transparency due to possible fraud, and long waiting times. Information can be accessed anytime and anywhere, and the movement of funds can be made at lower fees using cryptocurrencies. Moreover, password-secured networks enable fast and transparent payments.

The donor sees a list of villages in need of help on the GiveTrack platform, chooses a village to donate to, and sends bitcoins to the bitcoin address owned by GiveTrack; then the donation is made. Subsequently, donors can check the progress of the project in real time, including when, where, and how much of the donation was spent within the platform. The ability to track real-time transaction records on a blockchain reduces the risk of manipulation and errors, and it improves reliability. In addition, projects that want to donate have bitcoin addresses connected to BitGive, making it easier to create projects and receive donations.

Users of BitGive can not only donate using bitcoin but also using twenty-three traditional global currencies, as well as ten kinds of cryptocurrencies, such as Litecoin, Ethereum, and Dash. Donations through banks are expected to be sent within five-to-seven days, credit card payments are expected within twenty-four hours, and cryptocurrency payments can be completed within thirty minutes. On average, the project manager spent 10.96% (as of 2015) of total funds on transferring donated funds through the bank and 6.36% of total funds on using professional moneylenders. BitGive’s projects, through which remittances are made through cryptocurrencies, usually incur less than 1% of the fees received by the coin network, thereby reducing the international transfer fee [72].

BitGive received the 501(c)(3) designation from the U.S. International Revenue Service in 2014, becoming the first non-profit organization in the U.S. to conduct bitcoin-based philanthropy. This also allows donations through Bitcoin to receive tax benefits. BitGive has not only helped establish and activate donations through cryptocurrencies but has also brought about a change in perceptions on the use of cryptocurrencies as a means of donation.

4.2. AidChain

AidChain is an integrated ecosystem for donations that connects non-profit communities using AidCoin. With blockchain emerging in 2013, AidCoin was built on the Ethereum blockchain for enabling a transparent donation culture. Using AidCoin on the AidChain platform increases transparency of donations by enabling tracking of transactions. By connecting with the payment portal AidPay, the cryptocurrency donations are converted to AidCoin for increased convenience. By switching to AidCoin, charities can easily manage their donations in one wallet and increase transparency and traceability.

When a charity registers with the AidChain platform, it is issued a single address through verification. Tracking the actual use of the funds is possible through registered addresses in the overall process of exchanging money from donations to legal currencies. Additionally, it is possible to report the use of funds and track administrative costs in the blockchain. Donors can register anonymously or use some privacy protection devices, but they can also obtain donation certificates for tax reduction on donations through personal information registration of various grades.

Such real-time tracking ensures that funds allocated for a particular project are used for that project and helps in comparing the utilization efficiency of various charities’ funds. It also confirms that the

funds held by each charity are in compliance with the charity's investment contribution policy. In terms of cost, projects in developing countries may involve reduced financial costs, e.g., in transferring funds.

AidChain and AidCoin were developed by CharityStars, a charity fundraiser. One of CharityStar's key goals is to build strong ties between charities, celebrities, and big-name companies, which receive donations from celebrities, as well as to use donation proceeds from the auction for charity. The company is also increasing the convenience of participating in charity auctions by allowing cryptocurrency and AidCoin to donate through auctions.

AidChain has also attracted US\$10 million from major global charities such as Amnesty International, Save the Children, and World Wildlife Fund, and is seeking to expand its donations in collaboration with more organizations and companies.

In addition to utilizing blockchain technology to make the operation of non-profit businesses transparent, smart contract technology based on blockchains can be introduced to make operations simple and convenient.

4.3. Plans to Introduce Smart Contracts of UNICEF

UNICEF is an international relief organization under the United Nations that works for children in 144 countries. It is one of the most well-known non-profit organizations in the world, promoting non-profit projects related to international emergency relief, impact, vaccination, drinking water problems, environmental improvement, and basic education. It announced through UNICEF Ventures in August 2017 that it was seeking to use smart contracts with the Ethereum Foundation to lower the trust costs incurred when trading online.

Smart contract program transactions are executed automatically when certain conditions are met through blockchains and have been used for transfer of ownership, inheritance, or gifts. The technology has a programmed form of contract processing to automatically announce various types of contracts, including blockchain financial transactions, real estate contracts, identity payments, and overseas aid, through a shared network between the parties. Smart contracts are directly handled at no additional cost, enabling complex business contracts to be safely executed based on low cost and trust [73].

The technology was first introduced on the Ethereum blockchain systems. A token that processes work or trade on an Ethereum network is called an Ether, which is stored in an Ethereum address and is used to process transactions on the network. Ethereum records transactions faster than conventional blockchains and automatically generates blocks based on smart contracts.

The benefits of smart contracts can be leveraged to streamline processes in non-profit projects. By using smart contracts based on blockchains, one can solve the problem of wrong recipients receiving contributions or that of recipients misappropriating contributions for other purposes. Especially in developing countries, where financial systems are underdeveloped, there is a limit to managing the delivery of donations, and such problems are even more difficult to deal with. For example, if a donation is made for a sanitary pad for a female teenager, the recipient may be designated as the daughter in the concerned household so that the donation cannot be used for the parents' drinking or gambling habits. In addition, when the purpose of the donation is specified, the beneficiary may not withdraw it arbitrarily and only use and transmit to the designated use site.

UNICEF Ventures aims to use smart contracts to enhance efficiency, transparency, and accountability. When a smart contract is implemented, anyone can access and check the transaction contents to increase transparency and to re-establish governance through authority and autonomy.

4.4. Building Blocks Project of the UN World Food Programme (WFP)

The WFP conducts a large-scale overseas original research business, including transferring \$1.8 billion in 2018 for charity projects. In the case of international aid, the cost of the fee is as high as the amount being paid in cash when relying on local financial institutions in areas in which the banking system is not developed. In addition to the increase in costs, it causes many problems, such

as the delay of payment, payments to wrong recipients, or the leaking of private information due to mistakes by financial institutions.

To solve this problem, the Building Blocks project was implemented under the motto “Blockchain for Zero Hunger.” The purpose of the project was to protect recipient data and control for the risks of financial institutions by using blockchain technology. In 2017, it was tested in Pakistan’s Sindh region to approve and register beneficiary transactions through a blockchain. A blockchain was used to execute secure transactions directly and quickly without intermediaries and to confirm that the participants were directly connected.

A blockchain and iris recognition (EyePay) were implemented at the Azraq and Zaatari refugee camps in Jordan. The United Nations High Commission for Refugees (UNHCR) confirmed the beneficiaries by scanning their iris and allowing them to only purchase the food needed for their daily lives through a Jordanian dinar-based simple payment platform while allowing them to purchase cigarettes, cola, alcohol, chocolate, and ice cream with the WFP’s funding.

In the past, when using paper coupons, refugees suffered from the loss of food coupons, but now they can buy groceries with only iris scans. Combined with the biometric authentication technology of the UNHCR, it is possible to scan the iris, recognize the individual, and create an Ethereum-based private blockchain to record all transactions. The UNHCR office stores key personal information, including the biometric information of refugees, on a cloud server called “Icrowd,” which has been secured separately by the UNHCR; the WFP only downloads and uses some of the information needed to manage identification. Even as a refugee individual’s entire personal information cannot be recorded in a blockchain, they can be still recognized as individuals. In addition, Building Blocks is operated through the proof of authority agreement algorithm in a private blockchain created by Parity, one of Ethereum’s customers.

Blockchains have also brought about great improvements in cost. The WFP used check cards through existing financial systems, but financial institutions charge 1.5% of the transaction amount as commission. After using EyePay, WFP did not need to pay check card commission to financial institutions. The WFP has also drastically reduced the number of banking transactions to only sending money to a mart once a week and settling accounts with the mart only once a month by using blockchain as a ledger. The use of blockchains has resulted in a 98% reduction in financial costs for the WFP. Figure 1 shows the comparison of operations and costs before and after blockchain adoption. Additionally, blockchains have improved personal information protection. When the WFP used check cards, the details of the refugees’ transactions were taken outside the camp. That was a risk factor for the project operator. However, it is possible to protect personal information by using the EyePay internal system based on a private blockchain.

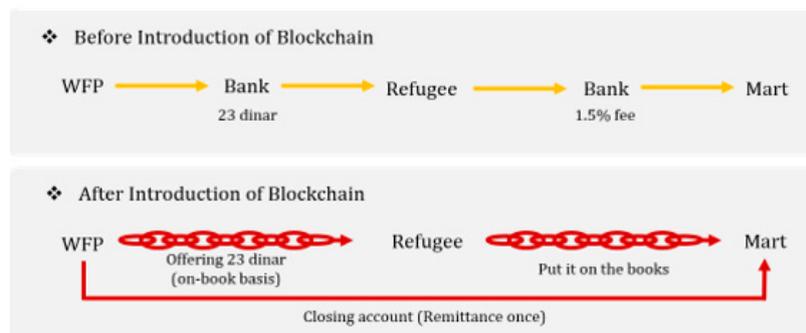


Figure 1. Cashflow before and after the introduction of a blockchain.

In terms of business management, sales books cannot be manipulated, resulting in a significant improvement in project management and governance, with 95% of the funding being used in the right place. Previously, supermarkets used to record purchases and charge them, but there was no way to find out if the supermarket manipulated the books and claimed more than actual refugees purchase.

With the application of the blockchain-based platform, 106,000 people use blockchain to receive support and use it comfortably, saving about \$40,000 a month in fees.

The WFP intends to apply a blockchain to aid the Middle East and Africa's food supply chain. It also plans to use blockchain technology to track food distribution in East Africa. The WFP will focus on the supply chain from the port of Zepi, which receives a lot of relief food, to Ethiopia, where most food supplies are re-delivered; the WFP expects to enhance the efficiency of relief work by checking the real-time delivery of the food.

Through blockchain, the WFP seeks to realize logistics, distribution, the convenience of payment, and even economic performance and personal information protection.

5. Discussion

5.1. Current Practice vs. Blockchain Applied Practice

Various attempts to use blockchain to overcome the limitations faced by NPOs have been examined through different case studies. A blockchain is not merely a database management system—it is a system characterized by transparency and immutability that can support the sustainable growth of NPOs by increasing donations through enhanced governance. This is examined for each level of NPO program operation followed by the solution on the existing practice through blockchain. Figure 2 shows the operation process of an NPO project.



Figure 2. An NPO's value chain [74].

An NPO project can be divided into fundraising operation, and program operations. As in the case of program operations, if the program is for a region with poor infrastructure, there could be problems with real-time updates due to information fragmentation. Data loss and incomplete transformation could occur through the process of having to combine information from each process if there is a lack of real-time monitoring. Intentional manipulation and fraud could also pose risks.

Poorly set up financial infrastructures in undeveloped regions cause limitations to services and high financial costs. There are also limitations in conducting programs due to the lack of financial inclusion by many beneficiaries. As was the case for WFP, the usage of financial intermediaries was minimized by using a blockchain for internal settlement, monitoring the usage of funds, and making the database immutable, all of which resulted in lower financial costs. With the implementation of a blockchain, users who have difficulties accessing financial services are able to receive the same level of benefits without the risk of personal information getting exposed.

As in the case of fundraising operations, current limitations can be overcome through the usage of crypto tokens and managing data through a blockchain. In regard to raising funds, donor convenience is increased along with the rise in interest and reliability of the project because the whole process from making donations to receiving of benefits can be monitored. Tokens can be rewarded for additional donations, and this can be donated again, helping the ecosystem to expand.

In terms of fund management, financial costs can decrease from reduction of intermediaries and risk, and this process is reflected in the blockchain, which the stakeholders have access to in real-time. Therefore, rather than having to refer to an annual audit report, real-time monitoring has become possible. As tokens are paid out only when the actual conditions are met, the usage of funds can automatically be restricted.

Table 4 summarizes the existing practice and the changes after applying blockchain according to each level of NPO's value chain.

Table 4. Comparison of current practice with changes after applying a blockchain to a value chain.

Category	Program Design	Fundraising	Fund Management	Program Delivery
Major Activities	-Develop implementation plan. -Capacity assessment.	-Fundraising activity. -Donor-led program design.	-Understand donor and funding requirement. -Donor reporting.	-Logistics -Provide information and communicate with stakeholders.
Current Practice	-Relying on local human resources. -Process design is different depending on beneficiaries' regional conditions. -Plan to track program implementation and manage related data.	-Approach local direct donation program or corporate donation. -Increase interest with advertisement or promotion.	-Manually monitor and gather partial information from each step. -Quarterly or annually prepare report and deliver information via email, mail or homepage posting.	-In case of global project, implementation is done by local team via many intermediaries. -Gather data spreading out the whole process. -Report quarterly or annually with limited data.
Limitation	-Manual design process. -Program design limitation in the poor infrastructure region. -Limitation or delay in tracking program performance.	-Inconvenience of donors due to limited donation method. -Incentive of donation is only goodwill. -Increase promotion cost.	-Manual management of restricted or unrestricted funds of the program causing delay in monitoring. -Delayed reporting with limited information.	-Operational limitation with high cost due to financial intermediaries. -Manual collection of partial data incurring high cost and low efficiency.-Delayed reporting with limited information.
Applying Blockchain	-Less manual with smart contract. -Reduces the process with intermediaries. -Real-time reporting process.	-Increases convenience through crypto token helps expand donor groups. -Increases interest by incentivizing the usage of token. -Tracks project status from donation to receiving of benefits.	-Tracks and monitors donations and the utilization of funds on a real-time basis. -Automatic fund management through smart contract. -Real-time information sharing with stakeholders.	-Build up digitalized blockchain infrastructure for fund and data management. -Collection of dispersed data. -Real-time information sharing with stakeholders.

5.2. NPO's Strategic Approach

Non-profit businesses are using blockchains to increase donations and enhance the efficiency and transparency of their business operations. Based on the cases studied above, we can organize the implications for NPOs into four stages, depending on the degree of increase in donations and governance of non-profit businesses. Figure 3 shows the NPO's blockchain application strategy according to NPO's goals.

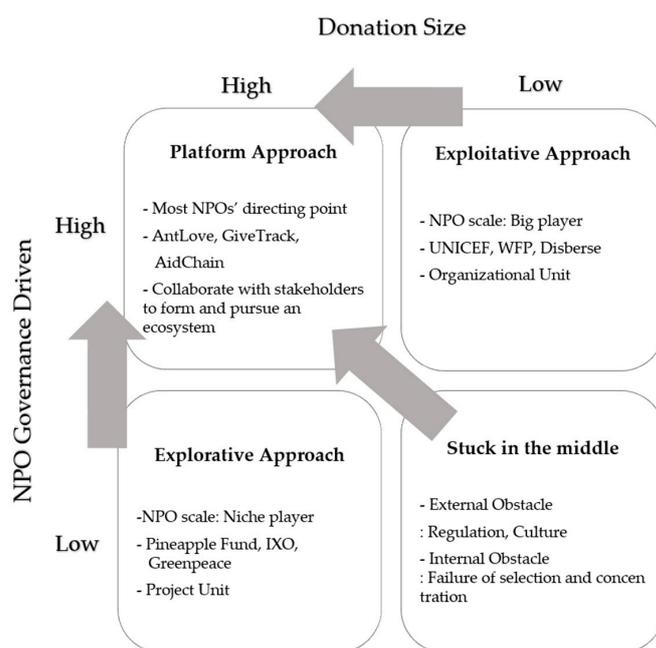


Figure 3. An NPO's blockchain application strategy for sustainable development.

5.2.1. Stuck in the Middle Stage

Low Contribution/Low Operational Efficiency

This is a situation that many small non-profit businesses are currently in. In this stage, if the internal power is weak or if the goal is not intensively pursued, the goal of improving business operations and increasing donations is not achieved.

Externally, rigid regulations and a culture of a slow acceptance of change have prevented an exploratory approach for the expansion of donations and an applied approach for the streamlining of operations and ensuring their transparency.

5.2.2. Exploitative Approach

Seeking Higher Operational Efficiency

This strategy aims to increase operational efficiency and transparency rather than the contributions. It is pursued by large international organizations through blockchain projects. Blockchains and smart contracts are used to improve operational efficiency and transparency. Instead of human or third-party participation, smart contracts are automatically executed when certain conditions are met, and information is recorded and shared through a distributed ledger. Technology should be used to exclude cost-inducing or corruption-prone elements from non-profit projects, while cryptocurrencies should be used to run their businesses.

Smart contracts from Disberse, UNICEF, the United Nations WFP, and other cases of UN blockchain platforms or interventions are typical of this stage.

5.2.3. Explorative Approach

Pursuit of Greater Contributions

This strategy is pursued by small niche non-profit companies that plan or operate new projects for increased contributions to form a business. Non-profit business operators that utilize this strategy focus on increasing donations, enabling their rapid transfer, and ensuring anonymity with cryptocurrency. The Pineapple Fund is a special case of an anonymous donor who provides cryptocurrency donations to various businesses, but Ant Love, Greenpeace, IXO, AidChain, and BitGive focus on expanding their fundraising through quick and comfortable donations through cryptocurrency.

5.2.4. Platform Approach

Expanding Donations and Seeking Operational Efficiency

This is a strategy that most non-profit businesses pursue: increasing donations and improving transparency and efficiency in their operations. As shown in the case of Ant Love, in which for-profit entities have pursued social contributions through the creation of shared value, participation by not only existing non-profit organizations but also by a number of stakeholders can be seen as an example of this strategy.

Blockchain projects for social causes, such as BitGive and AidCoin, are aimed at increasing donations as well as enhancing transparency in internal operations through blockchain platforms. In this stage, the company intends to operate the project as a platform with diverse uses, such as utilizing it for business operations. To pursue both objectives, NPOs should build a non-profit blockchain ecosystem by applying smart devices and cryptocurrencies, as well as blockchain-based distributed ledger technology.

Existing NPOs have difficulties in the internal decision-making process to reach this stage through internal efforts. They also have difficulty concentrating their capabilities beyond their essential business.

Externally, due to the limitations of regulation, technical knowledge, and the time it takes to embrace culture, which falls short of new technological changes, we can see changes being made with blockchain experts and external stakeholders. UNICEF and the United Nations WFP are working with the Ethereum Foundation to vigorously apply the technology to solve existing problems, in addition to reducing business operation costs.

Non-profit businesses that seek operational efficiency and transparency should apply technologies, such as blockchain and smart contracts. Thus far, we have looked at cases where blockchain has been used for increasing donations, ensuring anonymity, diversifying methods of donation, and overcoming limitations on the use of existing financial institutions.

NPOs should pursue these strategies simultaneously and leverage blockchains to create additional value. They should use blockchains and smart contracts to pursue transparency and to create convenient and scalable projects through cryptocurrencies. In addition, an NPO's value will be realized through the blockchain ecosystem, e.g., by giving value to the activities of donors. In order to pursue the strategy of application and challenge at the same time, an NPO should create an ecosystem with a blockchain and external experts to utilize external resources within the organization.

6. Conclusions

This study was about activating a blockchain for the improvement of an NPO's transparency and governance. NPO projects can be implemented with an improved efficiency of internal operations and vitalized donations through the use of blockchain technology. An NPO's goals are to increase donation and to enhance the efficiency of its operations. In the various stages of an NPO's business, each NPO applies a blockchain using an exploitative approach to seek a higher operational efficiency, an explorative approach to pursue greater contribution, and a platform approach for both at the same time.

This study has contributed the following regarding NPOs' use of blockchains.

First, we presented a solution for the transparency and governance problems that NPOs face with the introduction of new technologies. Blockchains were studied from the business and technical points of view and envisioned in the non-profit organization's operation and expansion. Through a blockchain, the entire process of donation can be recorded in an unalterable blockchain and shared with donors and project participants to boost donation. Donors may stop support or not actively participate in the donation operations of organizations if they are not satisfied with the project's operation vis-a-vis real-time surveillance.

Commercial enterprises have multiple means of monitoring and engaging in operations by third parties, but NPOs report and operate with limited costs and resources. An NPO is responsible for the operation and management of assets that are already provided, which is not a small liability compared to commercial enterprises. However, with a blockchain, operational information can be shared with multiple participants in real time, thus enabling efficient and transparent operations. For example, a blockchain records the basis for determining the beneficiary that meets the terms of the donation, and then it shares it and gives a fund as evidence. In particular, it is difficult to monitor the operational environment and the use of expenses in foreign countries. In developing countries where financial and information technology systems are not developed, it is difficult to identify the criteria and conditions for meeting the beneficiaries and to provide funding through banks. Therefore, it is difficult to know what an NPO needs for transparent project management.

In addition, through smart contracts, the management and operations of staff can be reduced to focus more on an NPO's core business. Smart contracts automatically execute tasks and contracts electronically under certain conditions, reducing the time and manpower required to run a business (compared to the previous situation wherein personnel checked the conditions and manually executed the contract) and allowing them to focus on the inherent performance of an NPO's business.

Smart contracts reduce the problems that can arise from arbitrary operations. The performance of an NPO is often abstract, and its definition is unclear, making it difficult to measure. The values

sought by each NPO are different, and it is difficult to measure performance with only material results or numbers. The autonomy of each operator and person in charge of operation may lead to arbitrary operations. In most cases, problems caused by random operations are recognized postmortem and are difficult to prevent. By predefining possible operational procedures and steps and by programming them through smart contracts, we can minimize operational problems caused by a person's arbitrary judgment. We also can maximize performance sought by NPOs by putting more time and effort into abstract but key tasks. The use of smart contracts, in addition to improved transparency and governance, will also contribute to the cost savings used in donor projects, thus allowing for more funding to be injected into an NPO's original projects by reducing the cost of the projects used in donors' donations.

Second, we presented an expansion plan for an NPO ecosystem using a blockchain. By using cryptocurrencies that arise from blockchains, it is possible to increase the value of the ecosystem, expand mutually beneficial joint economic zones, and achieve economic revitalization. Cryptocurrencies can be used by donors as an additional means of creating value, thus enabling donors to participate in the ecosystem. This is because community participation, donations, and information, which were not previously recognized as possessing material value, can be converted to material and monetary value using the blockchain's cryptocurrency and therefore be compensated. For example, when determining the method for an NPO's donation projects, a donor is asked to propose the project, and stakeholders vote through smart contracts to select the project. This allows donors to participate from the beginning of the donation project. This could be one way to solve the problem of NPOs, who are gradually liquidating their businesses due to a decrease in general donations and developing in a biased direction to only focus on projects with established ecosystems.

Third, we provided policy implications for the development of the NPO ecosystem. Existing government policies focused on monetary business support should be transformed into investments in underlying technologies and systems that can improve the transparency of the NPO ecosystem itself. Currently, NPOs are providing various types of information of each ministry to ensure transparent management, and they are using a lot of time and resources to do so. We suggest enabling a flexible and diverse method using blockchain technology and cryptocurrency for donors to participate, the efficient operation and disclosure of information using blockchain, and allowing new attempts under government regulation, such as the Sandbox system.

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