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BLOCKCHAIN AND PHILANTHROPY
Innovative giving and innovative taking

In this article the authors seek to address the opportunities and threats put together with adopting blockchain in the giving space.

1. EXECUTIVE SUMMARY

Blockchain is one of the most hyped technologies of the 21st century. Blockchain enthusiasts predict that, within the next couple of years, this technology will entirely disrupt the world we live in, including the world of giving. Philanthropists and many other involved stakeholders have developed unrealistic expectations about how blockchain can rejuvenate the third sector. The key benefit of blockchain for philanthropy is that it enables more transparency and accountability and can therefore provide the "proof of impact" for goals achieved. Despite such promising reviews, blockchain is still a young technology and its application brings with it a number of challenges. Blockchain is believed to have an overextended ability to provide trust, but many stakeholders do not entirely understand how the complicated algorithms behind this technology really work. Blockchain sceptics argue that the wrong data or incorrect metrics inserted into the blockchain will create meaningless chains.

2. WHAT IS BLOCKCHAIN?

Blockchain was first conceived as part of the peer-to-peer electronic money system Bitcoin [1]. It is a decentralised storage technology that can be used to store and transfer value or data across the internet. All data stored in a blockchain, such as Bitcoin transaction records, lives on thousands of computers (nodes), with anyone free to download the entire database and also participate in the network. Blockchains consist of blocks of data that are each linked to the previous block using cryptography in a way that makes it virtually impossible to alter data once it has been added. Even though the data on blockchains is (usually) public and no central entity controls it, its integrity and maintenance are ensured using cryptography and built-in economic incentives. Although different variations of blockchains exist (e. g. Bitcoin blockchain and Ethereum blockchain), the fundamental purpose of a blockchain is to immutably record data or events in sequential order, thus creating an incorruptible digital ledger. This technology enables the exchange of value between two parties, eliminating the need for the trusted intermediaries such as banks or companies that provide financial services [2]. Almost anything can be incorporated into a data file or an event – passwords, movies, music, images, dates and account balances (to name a few), even though not all types of data are well-suited to being stored on blockchains (e. g. for privacy reasons or because the storage of large files is usually economically more expensive on blockchains than elsewhere) [3]. Beyond the actual transfer of digital currencies, blockchain can be used for a wide variety of applications, such as cross-border payments, trade finance, voting systems, ownership tracking, copyright, provenance of documents, etc.

3. HOW CAN PHILANTHROPY BENEFIT FROM BLOCKCHAIN?

Blockchain in conjunction with philanthropy can benefit many stakeholders, including charitable organisations, donors and recipients. Blockchain could even help decentralise charities altogether, directly routing payments from a pool of givers to the recipients without the need for an intermediary in charge of managing the contributions. In this subsection, we discuss the key opportunities of using blockchain in philanthropy.

3.1 For givers

3.1.1 Transactions at a higher speed and lower cost. Transactions performed on blockchain can reach recipients faster and at a lower cost than if performed via other transaction methods [4]. To illustrate this, we compared the speed and cost

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of common transaction methods with the most popular cryptocurrency – Bitcoin [5]. Clearly these arguments also hold true for other cryptocurrencies with a related purpose, such as Ripple or Zilliqa.

For example, the speed and cost of an exemplary transaction of a remittance transfer of CHF 160 from Switzerland to Rwanda performed via Bitcoin would be CHF 0.25 in roughly 50 minutes [6]. By contrast, the same transaction performed via Azimo (that is, the "second-best option" as indicated by World Bank Remittance Prices) is about 28 times costlier, and it would take up to 24 hours for the recipient to receive the money [7]. The reasons for such differences in a transaction's speed and cost are rooted in the innovative ways in which blockchain technology deals with the transaction confirmation and transaction size.

Put simply, most banks rely on a model of payment processing known as "correspondent banking". This means that banks hold accounts with each other (either directly or through intermediary banks), and transactions are performed by debiting and crediting several accounts at each institution. All banks involved in a single transfer deduct fees from the money being transferred. Many banks post transactions in a "batch" at the end of the day and impose daily limits on the transaction size.

All crypto transactions, on the other hand, are posted real-time. Each crypto transaction is first broadcast to the network into a pool of unconfirmed transactions and then picked up by a global miner (that is, a member of a peer-to-peer network of computers) and added to the blockchain as part of a valid, mined block. This process is called confirmation and usually takes around 10 minutes, on average, in the case of the Bitcoin blockchain; other blockchains (e. g. Ethereum) are designed to generate blocks more quickly [8]. Since there is still a chance another miner will create another block at roughly the same time, and the blockchain network consents to including the other block, blockchain users tend to wait for at least six confirmations (i.e. six additional blocks subsequently mined) for a single transaction in order to be sufficiently sure that the transaction has been immutably added to the blockchain. As a result, the whole process may take up to 50 minutes.

There are no daily limits on crypto transactions and their costs are not calculated based on the monetary value of a transaction, but rather on factors such as transaction size, number of other transactions made at the same time, or the computational complexity of a smart contract. Hence, blockchain facilitates an exchange of value at a higher speed and lower cost between peers, while eliminating the need for trusted intermediaries. Because every transaction executed on blockchain is recorded near real-time and is available to everyone, blockchain can help to significantly decrease the cost of annual reporting on a charitable organisation's budget and spending, while increasing its overall transparency.

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3.1.2 Highly visible and traceable transactions. One of blockchain's most attractive features for the giving space is that it enables highly visible and traceable transactions, allowing givers to track all their transactions from the beginning to the end and verify where their funds went. By monitoring the entire sequence of transactions, givers can easily find out whether their funds reached their intended target. Well-documented and tracked transactions enable givers to make better-informed decisions when choosing between various charitable organisations for their future donations.

3.2 For recipients: more money, faster and increased security. One of the key benefits of blockchain for the recipients of money is that they receive more money than they would have otherwise. There are a number of reasons for this. The primary reason is that expensive transfer mechanisms are bypassed, which allows donors to send more money directly to the recipients. However, it also prevents fraudulent intermediaries from pocketing part of the money that was meant for the recipient. Ultimately, it increases the pressure on charities to operate more effectively and efficiently and therefore channel the maximum amount possible directly to the recipient.

4. WHAT ARE SOME OF THE LIMITATIONS OF BLOCKCHAIN?

No matter how useful the underlying technology is, or how widely it can be applied, there are real and substantial risks involved in blockchain. Like any new technology, blockchain has its limitations. Building social services around it prematurely may lead to unpredictable outcomes and lead to negative social implications. In this subsection, we discuss the key threats of using blockchain in philanthropy.

4.1 For givers

4.1.1 Overrated ability to provide trust. A common notion is that, due to its immutable nature, blockchain can redefine trust. Since the system itself verifies all transactions, the assumption is that users do not need a trusted central authority. Instead, blockchain users need to trust many distributed and anonymous participants (global miners). In practice, this means that blockchain has no central governing body or auditor that would take responsibility for the system's failure if needed. Furthermore, blockchain immutability is inordinately expensive. As blockchain networks grow, technical and storage requirements become more demanding, and transaction fees and response times needed to transact via blockchain platforms may increase.

Some blockchain enthusiasts go even further in overrating blockchain's ability to provide trust, arguing that smart contracts (e. g. via Ethereum) will replace today's binding legal contracts [9]. Smart contracts are defined as computer pro-

grams that can be stored in the distributed ledger of a blockchain system [10]. The blockchain system executes these programs automatically when the linked transactions are being processed. However, computer programmers are mainly responsible for "writing" these binding smart contracts. Despite their strong coding abilities, they might not be best informed about some legal nuances, regulatory updates and compliance.

Furthermore, amending smart contracts after deploying them, for either manipulation or advancement, is rather impossible. Any modifications require the network to create an additional record (or block) to confirm a change. Hence, if two transacting parties cannot reach a compromise on a change, they are stuck with the original agreement, forever. To prevent this, some computer programmers started rethinking the ways in which smart contracts could be improved. For example, they suggested designing the back-end of a smart contract that could be updated according to the need of the transacting parties. Although this solution could help in "real-time" improvements of smart contracts, it would also alter the key reason as to why smart contracts are superior to the current way of contracting – the blockchain's function of preventing transactions from being reversed.

4.1.2 High energy consumption and collateral damage. Many givers are preoccupied by the thought that their genuine intentions to help people in need could, at the same time, have some negative (and mostly unpredictable) consequences on their lives.

Because Bitcoin and other cryptocurrencies store every transaction from their inception, this technology can help givers verify whether their funds were spent in line with their intentions. But the price of such monitoring power is a high carbon footprint. The crypto-mining process is a massive consumer of energy. Research published in Nature Climate Change (October 2018) even suggested that Bitcoin mining alone could push global warming "above 2 °C within less than three decades" [11].

The extended debate over this issue has, however, led to the conclusion that Bitcoin's biggest problem is not its massive energy consumption, but that its network is mostly supported by coal-fired power plants (i. e. between 2014 and 2017, about 90 percent of global Bitcoin trading happened through Chinese trading platforms). Indeed, other existing methods like wind energy, geothermal and hydropower energy could provide renewable energy to sustain the mining process [12]. But these alternative methods are mostly being explored in only a few geographical areas, such as Europe and the Pacific Northwest.

Many researchers are pushing for a more sustainable use of this technology. They point to the level of energy abuse of blockchain applications, comparing them to other payment systems such as VISA. Accordingly, they have estimated that a single Bitcoin transaction consumes as much energy as 100,000 VISA transactions [13].

The differences in energy consumption between blockchain applications and other common transaction methods are so extreme that computer programmers have attempted to improve the mining process itself. The key to the mining process is the proof-of-work, in which the global miners confirm transactions or dig up new coins. More recently, some energy-efficient methods such as proof-of-stake were created to perform the mining and substitute the energy hungry proof-of-work. In a proof-of-stake blockchain, coin owners create blocks instead of miners, and therefore do not require power-hungry machines that produce as many confirmation hashes per second as possible. Despite the fact that there are many different versions of proof-of-stake, none has yet been proven to perform to the expectations of its developers [14].

The energy consumption of various blockchain applications continues to rise exponentially. Hence, givers, especially those who are environmentally conscious, need to choose whether they truly need the monitoring power that innovative giving brings or whether they can stick to simple and traditional giving.

4.2 For recipients: uncertainty and cyber-crime. With increasing volumes of transactions running through crypto exchanges and other applications on blockchain, tracing where the money is going will become harder. This can therefore make cryptocurrencies attractive to more criminals as a means of committing crime. They may use blockchain for tax evasion or ransomware and illegal marketplaces to sell anything, including drugs, fake passports and firearms, etc [15]. Forcing their victims to pay via cryptocurrencies, they can profit from their illegal actions while remaining unidentifiable. All that external parties can view on blockchain are the long alphanumeric codes which represent the users' accounts (addresses) and transactions. Hence, the blockchain's function of preserving the user's anonymity can make it impossible to prove the guilt of many fraudsters. Furthermore, only confirmed transactions are recorded and displayed on blockchain, not unconfirmed transactions.

Fortunately, it is becoming increasingly challenging to participate in the major blockchains and exchange cryptocurrencies into fiat currencies [16] without undergoing a know-your-customer (KYC) process with a crypto exchange. This often includes uploading a government-issued ID and a photo of oneself holding the same ID, as well as a phone number and address verification in many cases. Moreover, once a malicious actor is identified and connected to a blockchain address, the blockchain provides public, immutable proof of all transactions made with this address.

But combining autonomous smart contracts with an anonymous cryptocurrency provides more sophisticated methods of committing fraudulent actions. One example is misusing smart contracts to automatically release information only a targeted victim has made a payment [17].

In 2017, it was reported that the largest 1,000 Bitcoin accounts held 40 percent of all the Bitcoins in existence – with almost 20 percent in just 100 accounts [18]. Law enforcement officials realise that, given such power, individuals can act unethically to increase or decrease the price of some cryptocurrencies. Because blockchain is such a complex and open-source system and remains a challenge for many regulators, some of these unethical actions might not even be illegal [19].

Hence, innovative recipients could fall victim to cybercrime. What adds to the uncertainty for them is the ambiguous regulatory environment surrounding this technology. The lack of clear legal protection could be harmful for blockchain recipients of donations in the long term. The blockchain's immutable nature would store indefinitely the fact that they once relied on financial aid. If the recipients' identities were ever disclosed, it might have unpredictable social consequences on their lives. For example, small or rural communities might punish recipients if they were not deemed by their peers to have been in the greatest need.

5. HOW IS BLOCKCHAIN USED IN PHILANTHROPY TODAY?

It is evident that there are many different possible scenarios in which blockchain can be applied to philanthropy. However, when we look around and assess real-world applications, we realise that this is still a niche approach and certainly a long way from mainstream adoption. Nonetheless, we want to briefly highlight three concrete examples.

5.1 Fundraising with crypto. In December 2017, an anonymous early adopter of Bitcoin under the nickname "Pine" donated BTC 5,057 (USD 86 million) to charitable causes. This was how the Pineapple Fund was established. To date, over USD 55 million of Bitcoin have been donated to about 60 charities through this fund, including Watsi (USD 1 million), The Water Project (USD 1 million), the Electronic Frontier Foundation (USD 1 million), the Bitgive Foundation (USD 500 thousand), MAPS psychedelic studies (USD 1 million), and the Open BSD Foundation (USD 500 thousand) [20].

5.2 Charity coins. AidCoin is a type of token. Its creators aspire for AidCoin to play a leading role in the new era of fundraising. AidCoin is to become the preferred method of donating (via Ethereum blockchain) transparently [21]. This cryptocoin has already been adopted in some charitable auctions, such as "Meet Cristiano Ronaldo at a Real Madrid Home Game" [22] and "Attend the Versace S/S 2018 Fashion Show in Milan and Meet Versace" [23].

5.3 Crypto-foundations. The BitGive Foundation describes itself as the world's first Bitcoin non-profit. Since its founding in 2013, it has partnered with many key stakeholders and non-profits in the charitable sector, including Save The Children, The Water Project, Fundación Parlas and TECHO [24]. Their project to bring clean and safe water to the Shisango Girls School in the Kakamega District of western Kenya was entirely funded by the Bitcoin community [25].

6. WHAT'S NEXT?

We argue that blockchain can indeed improve the current state of philanthropy by enabling givers to give more effectively, better allocate their resources, and have full transparency on where their donations are actually going and where they are being put to use. However, there are also certain challenges associated with widespread adoption of blockchain in the giving space. Blockchain's high energy consumption can be the source of collateral damage. This technology is quite complex and can be misused by cybercriminals [26]. One important milestone in addressing these challenges could be to create a coordinating body to help surface new solutions, guide blockchain and digital currency application in the third sector and take responsibility for system failure if needed [27].

Although we would be wise not to get too swept away by the hype, NGOs and philanthropists should begin learning more about blockchain's unique capabilities and help shape the field. Many relevant stakeholders in the third sector such as the Bill and Melinda Gates Foundation, Unicef, the World Bank, Consensys [28] and the Blockchain for Social Impact Coalition are already exploring blockchain for philanthropic ends.

Breakthrough technologies such as blockchain, the Internet of Things (IoT) and artificial intelligence (AI), alone or in combination, might provide novel and unconventional solutions to the major social challenges of the 21st century. Yet it is still an open question as to whether a use-case for blockchain (and other technologies) in philanthropy is desirable, feasible and viable, and whether existing and proven technologies are – if implemented rigorously – sufficient and can achieve the desired goals. All of this is yet to be seen. ■

Footnotes: 1) https://bitcoin.org/bitcoin.pdf **2)** https://qz.com/628581/blockchain-a-new-mechanism-for-trust-no-intermediary-required/. **3)** https://blockgeeks.com/guides/what-is-blockchain-technology/ **4)** Jayasinghe, D., Cobourne, S., Markantonakis, K., Akram, R. N., & Mayes, K. (2018). Philanthropy on The Blockchain. **5)** The authors are very much aware of the technological limitations of Bitcoin compared with other cryptocurrencies, but to date it is still the most visible and popular currency, which is why we use it as an example. **6)** https://remittanceprices.worldbank.org/en. **7)** Please note that we are restricting our comparison to common transaction methods that allow a recipient to receive a donation directly on a device without having to visit a local bank. **8)** https://www.blockchain.com/en/charts/avg-confirmation-time **9)** http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html. **10)** https://cryptorating.eu/whitepapers/Ethereum/Ethereum_white_paper.pdf. **11)** https://www.nature.com/articles/s41558-018-0321-8. **12)** https://theconversation.com/stop-worrying-about-how-much-energy-bitcoin-uses-97591. **13)** https://digiconomist.net/bitcoin-energy-consumption **14)** http://www.vertatique.com/bitcoin-mining-highlights-green-ict-issues. **15)** https://www.fireeye.com/blog/threat-research/2018/04/cryptocurrencies-cyber-crime-blockchain-infrastructure-use.html. **16)** The term "fiat currencies" includes all modern currencies with bank notes such as the USD, CHF, EUR, etc., and indicates money does not have an intrinsic value, i.e. the paper the bank note is printed on is essentially worthless (as opposed to silver and gold coin which have intrinsic value). **17)** https://theconversation.com/by-concealing-identities-cryptocurrencies-fuel-cybercrime-82282. **18)** https://www.bloomberg.com/news/articles/2017-12-08/the-bitcoin-whales-1-000-people-who-own-40-percent-of-the-market. **19)** US law enforcement identified and acted against some fraudulent actions linked to cryptocurrencies such as "spoofing" (that is, placing orders but cancelling them before finalising the deal without having to pay a service fee) or "wash trading" (that is, setting up several accounts and trading with oneself). Both artificially increase the demand and value of cryptocurrencies. **20)** https://pineapplefund.org/. **21)** https://www.aidcoin.co/. **22)** https://www.charitystars.com/product/meet-cristiano-ronaldo-at-a-real-madrid-home-game. **23)** https://www.charitystars.com/product/attend-the-versace-fashion-show-s-s-2018-in-milan-and-meet-santo-versace. **24)** https://www.bitgivefoundation.org/. **25)** https://www.huffingtonpost.com/ameer-rosic-/goodbye-corrupt-charities_b_13207806.html. **26)** It is becoming increasingly hard to participate in the Bitcoin network without providing an ID to an exchange. Other blockchains offer greater privacy. However, all transactions on them still leave a public trace. **27)** https://ssir.org/articles/entry/digital_currencies_and_blockchain_in_the_social_sector1. **28)** https://blockchainforsocialimpact.com/.