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Cryptocurrencies, Blockchain and Development Cooperation

Bitcoin and other so-called cryptocurrencies have become an increasingly important topic. Whilst the prospect of decentralised monetary regimes has been met with mixed reactions, underlying technologies such as blockchains and smart contracts are discussed and already tested in most areas of the economy.

In the past, alternative methods and innovations were quickly adopted in development cooperation due to the special requirements this area poses. Many agents in the development sector and adjacent policy areas also consider these technologies as potential tools to improve the way international development cooperation is conducted at present.

The Article gives a brief overview on cryptocurrencies, blockchain technology, smart contracts and analyses the technical functionalities in order to understand the potential implications these technologies can have for the transformation of development cooperation.

Schlagwörter:
Bitcoin - Ethereum - cryptocurrency - blockchain - smart contract - remittances - hawala - development cooperation - development aid - land title - IVTS

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At latest when bitcoin hit its all-time-high of nearly 20,000 USD on 17th, December 2017[1], crypto currencies had been on everybody's lips and talk of the revolutionary blockchain technology permeated many sectors of the economy and the society as a whole. Merely a short time later though, the value of bitcoin started to plummet against the US-Dollar and talks of a speculative bubble gone bust quickly made the rounds. Since then, media attention has moved on to other topics, but contrary to earlier speculations, crypto currencies have by no means disappeared. The underlying technologies and applications thereof – some of which might find use in development cooperation – keep developing. The article gives a brief overview on cryptocurrencies, blockchain technology and their background, and an analysis of the technical functionalities in order to understand the potential implications these technologies can have to transform development cooperation. To bridge the gap between theory and practice, these applications are illustrated by real use cases in development cooperation.

Where did it all start?

On October 31st, 2008 a short academic paper called *Bitcoin: A Peer-to-Peer Electronic Cash System*, published under the name of „Satoshi Nakamoto", proposed the concept of a distributed application architecture enabling direct online payments that would render the need of a centralised financial institution superfluous[2], while at the same time solving the problem of double-spending. Bitcoin is credited with having found a way to prevent that digital files, representing monetary units, are copied and spent multiple times without the desideratum of verification through a centralised institution.

Even though various people were allegedly identified as "Satoshi Nakamoto" and several people claimed to be the person in question, as of the writing of this article, the person, group or institution behind the pseudonym has not been identified beyond doubt. The foundations for such an electronic cash system had actually already been laid out much earlier by cryptographers, working on secure communication.[3] By the time Nakamoto published his paper, some video games already had virtual currencies built into them and pointed out their potential use.[4] A few years later, Bitcoin's[5] open source project, which had developed from Nakamoto's white paper, expanded the network's infrastructure. Shortly after, a range of so-called altcoins emerged. These are essentially alternative cryptocurrencies to bitcoin, often a variant ("fork") of bitcoin using a slightly changed form of bitcoin's original open source protocol.[6] Some, like Ethereum, expanded Bitcoin's repertoire of applications. Ethereum for example is better known for being a decentralized platform running smart contracts,[7] than for the cryptocurrency associated with it and as such has been the basis for UN-powered[8] projects in the development cooperation sphere. In

essence, the term smart contracts, coined by cryptographer Nick Szabo, denominates self-executing contracts following an "if…, then…" logic, which facilitate automated operations such as value transfers.[9]

Besides, there are tokens that, generally speaking, are representations of tradable assets or utilities that are distributed through so-called Initial Coin Offerings (ICO), or more recently, Security Token Offerings (STO), roughly comparably to Initial Public Offerings (IPOs) on stock markets[10] and hence a means of funding project development.

By the end of 2017, cryptocurrencies had grown to over 570bn USD in market capitalisation[11] and the crypto environment became increasingly interwoven with the established financial industry. Examples include co-operations between banks and crypto exchanges[12] and currencies,[13] bitcoin futures, ICOs and increased institutional investment. Around the same time, Venezuela's Head of Government Nicolás Maduro announced the creation of the first official[14] national cryptocurrency called Petro on his weekly television and radio programme,[15] which was introduced shortly after.[16]

Perceptions of cryptocurrencies

In the short time crypto currencies have been around, different notions of what lies at the heart of this new development have emerged. Whilst Nakamoto's essay lay emphasis on Bitcoin being a Peer-to-Peer electronic cash system, the burst of the bitcoin bubble indicates that many people understood it as a speculative tradable asset class. The general perception of crypto currencies however, is tied to the term itself. They are assumed currencies along the lines of traditional fiat currencies, that is legal tender whose value is backed by the government that issued it.[17] In legal terms though, "currency" refers only to the specific form of minted money that is in general use within a country, none of which can be said of cryptocurrencies. By the same means, from a legal point of view, electronic money is not considered legal tender either.[18] Nevertheless, both are - of course to varying extents - accepted and commonly understood as money. Meanwhile, the first component of the term, "crypto", often seems to be associated with somewhat opaque digital properties of these currencies, whereas it actually owns its name to the cryptography involved.

Over time, it has become a habit to talk about "crypto currencies" and examples like Venezuela show, that there may be a case for the use of decentralised cryptocurrencies[19] as substitute for fiat currencies in times of economic turmoil and instability. Those responsible for money creation in today's financial system – the central banks – and other major figures in the finance industry have not agreed so far, on how to classify these developments and whether to put a stop to them.[20]

What are Bitcoin and other cryptocurrencies?

One way to gain more clarity on this matter is to understand how bitcoin and other cryptocurrencies work and what their underpinning technologies are. First, it is important to note, that the term Bitcoin can stand for different concepts. It can stand for a decentralised Peer-to-Peer network as a whole, which hereafter will be called Bitcoin with a capital B and the reward for participating in the verification of transactions, in the following written as bitcoin in small letters.

„Satoshi Nakamoto's" whitepaper was titled *Bitcoin: A Peer-to-Peer Electronic Cash System.* To keep things simple, the concept of "Peer-to-Peer" networks can be perceived as two or more connected computers that share resources without going through a separate central computer. In the case of Bitcoin, the term therefore refers to a distributed application architecture allowing for direct online payments without going through a centralised financial institution.[21] So, what does that mean? In all elec-

tronic payment or transfer systems, costs occur for labour, resources and equipment to process and verify payments. In a centralised system, there are clearly defined central authorities that bear the incurring costs and in turn charge fees, e.g. transfer fees, for their services. Examples include banks, international money transfer providers or credit card companies.

The question then arises as how to handle costs and verify transactions in decentralised payment systems. In the case of Bitcoin, an incentive mechanism has been put into place for the network and thus its members, to provide the required resources to verify transactions.

This is where crypto currency mining comes into play. All transactions processed through the system are permanently stored in files – called blocks – with a certain maximum data size. In the case of Bitcoin, these are conceptualised as permanent stores of transaction records, even though they can technically store all kind of information. Every transaction is verified by certain types of nodes (connected computers) in the network, called full nodes and written in a public ledger that is available to anyone at any given point of time and allows the backtracking of all transactions.[22]

This verification is achieved through particular consensus mechanisms. In the case of Bitcoin, the mechanism used is known as proof-of-work. Broadly speaking, it poses a mathematical problem that is hard to compute but entails the possibility to easily prove the solution to it.

This publicly available ledger can be regarded as a chain of completed blocks and is therefore called blockchain. Hence, the blockchain is simply the longest record of all transactions in the history of the currency.[23] Metaphorically speaking, if the ledger is the whole book of all records, then the current block can be regarded analogically as a page containing the most recent records. Every time a page is full, the next page has to be started. Likewise, each time a block is 'completed', meaning its maximum capacity is reached[24], it gives way to the next block in the blockchain. That means, that in theory it is virtually impossible to alter the stored data in retrospect – at least far more difficult than in the case of other available technologies.

Each block is associated with a numerical problem posted by the system. Once this problem is solved, essentially by computer-powered guessing, the block is completed. This operation is called mining, and nodes that mine are called miners.[25] Every time (under certain conditions) a miner solves such a problem by means of server power and completes a block, he or she is rewarded a newly created – but in the case of the Bitcoin network decreasing – amount of cryptocurrency. This incentive makes sure that miners constantly process and record transactions and keep the network stable and secure[26].

Cryptocurrencies and Informal Value Transfer Systems

Alternative value transfer systems as such are nothing new, nor is their use by national development agencies, international organisations or NGOs.[27] So-called Informal Value Transfer Systems (IVTS) or Informal Money Transfer Systems (IMTS) have existed for hundreds of years[28] and are still used alongside and in combination with the international financial system, often for remittance purposes. The International Monetary Fund estimates that remittance flows through informal channels are at least 50% larger than recorded remittances through formal channels.[29] The World Bank expected official remittances to have grown to 528bn USD in 2018,[30] which would leave remittances through IVTS at around 780bn USD, and hints at the magnitude cryptocurrencies could potentially reach. IVTS do not constitute a uniform global phenomenon. This umbrella term encompasses an array of socio-culturally shaped trust-based systems. Examples include the South Asian Hun-

di/Hawala systems[31] and similar systems operating in South East Asia, the Middle Easten Hawala, the Chinese qian fei[32] and the Colombian[33] and Venezuelan US-Dollar black markets (in the latter case increasingly interwoven with crypto currencies). In some respects, they are not dissimilar to crypto currencies and related technologies. There is no unanimous stance as to what their legal status comprises but in many cases, they offer a cheaper, faster and broader access, especially to hard-to-reach or war-afflicted areas, than the conventional financial system does.

Hawala for example was used in Afghanistan by the United Nations, most NGOs, and the Danish Ministry for Foreign Affairs[34] amongst others. In the form of the Danish International Development Agency (Danida), the latter has also been forward thinking about the use of blockchain technology and cryptocurrencies in aid-delivery. With industry partners, Danida published a report in late 2017, detailing out the potential advantages associated with it.[35]

Potential uses for the aid-delivery process and other areas of development cooperation

In order to point out potential benefits of cryptocurrencies and blockchain technology, the status quo on how development aid is channelled to beneficiaries has to be taken into consideration. Broadly speaking, aid money is delivered to the beneficiaries in monetary or other form through intermediaries. Different players along the way, such as international institutions, NGOs or local organizations take the role of trust brokers and aid distributors verifying the transaction, whereas the total cost for the sending institution is comprised by the costs cumulated at each step.[36]

In a report published in 2017, Danida et al. identify three major ways to re-design the current aid-delivery model. Bypassing intermediaries to deliver more aid with less bureaucracy in a shorter time span, speeding up response times (by skipping drawn-out verification processes) and transforming the way funding is planned and allocated i.a. by comprehensive data generation.[37]

Taking these concepts to an ideal world, an emergency in any corner of this planet would be registered, and once ticking, certain pre-selected criteria or reaching predefined thresholds, smart contracts would then automatically initiate immediate emergency relief transfers in “aid coins” directly to the beneficiaries identified, bypassing all intermediaries, transfer costs and paperwork. The report proposes to redesign “Danida as a service” instead of allocating pre-defined funding across different areas.[38] Danida floats the idea of developing into a blockchain-powered platform, onto which other actors can dock with their aid proposals, which would then be allocated case-dependent as per their suitability.[39] It remains to be seen by which criteria the most suitable aid would be identified, how the final mile towards the beneficiaries will be bridged and to what extent these can participate in this process.[40]

The arguments mentioned revolve around the direct benefit for aid-delivery from an operational point of view. Nevertheless, the use of cryptocurrencies, blockchain technology and smart contracts can also be seen in a greater context such as the United Nations 2030 Agenda for Sustainable Development. Financial inclusion features prominently as a target in eight of the 17 Sustainable Development Goals (SDGs).[41] The reduction of remittance cost is explicitly mentioned but there are more areas where blockchain technology could make a difference. Digital identities and financial products for the unbanked such as blockchain-powered prepaid accounts come to mind in the case of refugees or other vulnerable groups without proper documentation. New ways of (micro) business funding provide further food for thought. As of mid-2017, the United Nations Development Programme identified an investment gap in developing countries of about 2.5tn USD to

reach the SDGs.[42] ICOs and Peer-to-Peer networks could help to unlock new sources of funding for the SDGs as a whole. Furthermore, capital tied up elsewhere could be freed by new cost efficiencies and redirected towards these goals.[43]

Cost and time savings can also be expected in the wake of smart contracts and the possibilities surrounding automated transfers, for example in case of emergency relief, payments such as salaries, or, in a broader and more national context, even the collection of taxes. The international accounting firm PwC also identified potential uses for blockchain technology in sectors as diverse as clean power, smart cities & transport, sustainable land use/production/consumption, pollution control, fishing monitoring, water security etc.[44] The focus in this stream of thought is set on the inherent attributes of the blockchain as transparent, trackable and highly immutable store of records. As mentioned above, all kinds of information could be stored in the blockchain. Further possible applications along these lines therefore include the recording of payments for corruption prevention, the storing of property titles and hence, if enforceable, protection of property rights, the tracking of sales records of conflict minerals or arms, etc.[45]

Real world use cases in development cooperation

Speaking about cryptocurrencies, the most evident form of use would be what Danida calls "aid coins" in form of one or several specially designed aid cryptocurrencies.[46] Bitcoin transaction volumes[47] in countries like Venezuela indicate that decentralised cryptocurrencies could indeed be a means to fall back to in monetary/economic and political crises, but of course, in a centralised form they can just as well be used as a means of exercise of political power. Either way, national development agencies, international organisations and NGOs have to abide the national and international laws within which they operate. In the concrete case of Venezuela, by all likelihood, this would render the use of official foreign or international crypto aid money infeasible. Furthermore, as regulators and central banks around the world keep arguing about how to define, classify, regulate or even ban cryptocurrencies, for the moment being, it is the blockchain technology that comes to the fore. In order to bridge the gap from theory to practice, real world use cases for blockchain adoption in humanitarian aid and development cooperation will be discussed hereafter.

Examples for blockchain use in development cooperation

UN Ventures

At an international level, innovation can be expected to come from UNICEF Ventures, the venture arm of the United Nations International Children's Emergency Fund (UNICEF).[48] This 17.9mn USD Venture Fund was launched in 2016.[49] In cooperation with Danida and the Finnish Ministry of Foreign Affairs,[50] UNICEF Ventures explores emerging technologies and data science in order to enhance its assistance worldwide. Amongst others, it puts Ethereum-based smart contracts "as a tool for improved efficiency, transparency and accountability" to trial[51] for future use. Funded projects include emerging market start-ups in areas as diverse as drones[52], data science & AI,[53] VR&AR and blockchain technology.[54]

Building Blocks

The United Nations World Food Programme (WFP) already went a step further. WFP assistance is increasingly delivered in the form of cash transfers, with the cumulated sum of transfers in 2018 alone reaching around 1.6bn USD.[55] With promising potential applications in mind, the WFP set out to confirm the feasibility of blockchain-powered solutions in a pilot project in Sindh Province, Pakistan. The outcomes of this pilot project

read as follows. Increased cost efficiency through omitting financial service providers was achieved, faster crisis-response due to reduced paperwork was acknowledged and better control and transparency of both beneficiary data and financial risk by virtue of the blockchain's high immutability were equally noticed positively.

Consequently, the programme, called Building Blocks was scaled up significantly to the extent, that as of October 2018, more than 100,000 people residing in Jordanian refugee camps redeemed their WFP-provided assistance through Building Blocks. Furthermore, the system was aligned with the Office of the United Nations High Commissioner for Refugees (UNHCR) existing biometric authentication technology Eyepay[56], allowing refugees to identify and execute various operations including payments in in-camp supermarkets through iris scans.

As next step, the number of Syrian refugees in Jordan to be covered by the project will expand fivefold to all 500,000 Syrian refugees in Jordan receiving support from the WFP.[57]

MONI

In Europe, too, Blockchain solutions are already put into practice to deal with what has been coined "migration crisis". Without paperwork, it is impossible or at least extremely difficult to prove your identity, open a bank account, get a (legal) job or even access to government services. This problem can be tackled with blockchain-powered solutions by enabling trackable and highly immutable records of transactions linked to unambiguous digital identities.

The Finnish fintech start-up MONI had been commissioned by the Finnish Immigration Service in the framework of a pilot project already in 2015 to provide refugees with Prepaid "MasterCards" and mobile first payment accounts.[58] These are linked to a unique digital identity stored on a private blockchain[59] and allow for direct payments from the government bypassing traditional bank accounts and the corresponding documentation prerequisites. This enables refugees without documentation to settle in faster and participate - to a certain degree - in everyday social life. Furthermore, if connected with biometric data, it simultaneously makes fraud and multiple identities more difficult and reduces the risks of theft and corruption. In addition, monitorability and accountability for all parties involved increase, and overhead costs caused by extensive paperwork decrease.

ID2020

Not only start-ups are venturing into the crypto space. In a similar vein, multinational companies like Microsoft or management consulting firm Accenture have started to join non-profit organisations in public-private partnerships such as ID2020, imparting new momentum to the adoption of blockchain-based applications in development cooperation and foreign aid. The use of economics of scale enabled by the financial firepower provided by such companies could indeed accelerate the development of blockchain/cryptocurrency applications. Again, this cooperation emphasizes the facilitation of services based on the creation of a digital identity.[60] First pilot projects were launched in 2018 in cooperation with the International Rescue Committee and national authorities in Thailand and Indonesia. The initiative in the Mae La refugee camp in Thailand, close to the Myanmar border, attempts to provide digital identities to its approximately 35,000 residents and builds up on iris recognition technology and blockchain-based digital identities to facilitate access to healthcare services.

The Indonesian project, in contrast, focuses on streamlining subsidies to beneficiaries through biometrically backed digital wallets, basically the digital and encrypted form of physical wallets.[61]

Land registration

There are also real-world examples for the use of blockchain technology in the recording of land titles. Projects in Georgia, Sweden and Honduras are standing out here, though progress in the latter has stalled.[62] Georgia and Sweden meanwhile, are close to the top brass of the countries with regard to property registration according to the World Bank Doing Business Report 2018[63], which is pointing to a fundamental problem. Reducing fraud and land grabbing, resolving land disputes and freeing up unsecure capital assets could indeed be a strong economic growth impetus. However, whereas a blockchain-based land registry system could hypothetically prove ownership of land, it is inherently subject to the encompassing institutional framework.

That means that the potential advantages of the blockchain are dependent on the initial registration of the property, the consensus mechanisms implemented by the government, and thus the ease of overwriting records and finally the enforcement of property rights. Nevertheless, real use cases like the National Agency of Public Registry in the Republic of Georgia show that – embedded in the right institutional framework – blockchain-based land registry systems can work and benefits such as accelerated administrative processing periods achieved.[64] Further Eastern European countries including Estonia and Slovenia are following suit in experimenting with blockchain technology for their part.[65] Stakeholders in other corners of the world also focus on problems revolving around land disputes. In India[66] for example, the United Nations Development Programme[67] and government bodies are engaged in several projects, whilst in various African countries start-ups[68] are working on making blockchain land registry systems feasible.

Conclusion and potential hazards

Regardless of the advantages and potential future uses cryptocurrencies and blockchain technology introduce into the space of humanitarian aid and development cooperation, there are also drawbacks and potential hazards associated with these technologies. Just as in the case of cryptocurrencies, the legal status of smart contracts remains unclear in many jurisdictions, and legal impediments could hamper the use of substantial aspects of the applications shown above.

The next point might of course be subject to technological improvements, but as of last year, electricity requirements of bitcoin transactions alone were comparable to those of the state of Ireland.[69] Therefore the question of sustainability is self-imposing if SDGs shall not be reached at the expense of other ones.

Moreover, the volatility of digital currencies could render the adoption of cryptocurrencies impractical for financial aims. However, examples for fiat-pegged or at least partially backed cryptocurrencies called stablecoins such as Tether, TrueUSD or Paxos[70] already exist and there are some indications that, at least in the case of bitcoin, cryptocurrencies might not be as volatile and risky as widely acclaimed.[71]

Furthermore, if not combined with additional technology such as the iris scanners used by the UNHCR, most benefits associated with these technologies are limited exclusively to those in possession of mobile devices. If combined with the aforementioned technology, another question arises. The blockchain was conceptualised as a decentralised distributed and public ledger. Will consensus mechanisms such as proof-of-authority[72], that essentially centralise the decentral blockchain, hand too much power to centralised bodies? Are there checks and balances in place to prevent misuse by those overseeing them? And most important, will blockchain-powered solutions really outpass other technologies

and instruments in terms of costs, functionality and ecological footprints? What is more, even though blockchains are regarded as very difficult to modify, the examples of cryptocurrencies such as Ethereum Classic, Verge, Monacoin or Bitcoin Gold have shown that they can be compromised. Smart contracts constitute another possible gateway for attackers as the case of the Ethereum Decentralized Autonomous Organization (DAO) showed in 2016.[73] Can blockchains be configured in such a way that they efficiently safeguard privacy rights? This question applies especially if the digital identity stored in the blockchain encompasses data such as iris scans, fingerprints etc.

It can be turned around as you like, some dangers pertain but as with other technologies, opportunities may prevail and could have a significant impact on development cooperation.

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