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Blockchain and society

Toni Caradonna[1]

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Abstract
In this text, the origin of blockchain technology is explained and put into the context of three waves of digitalization: digitalization of information represented by the internet, digitalization of communities and community building tools represented by social media and digitalization of value represented by blockchain. The text will show that blockchain can bring back promised features of digitalization of the first two waves, features that were lost with centralization tendencies created by business models that are independent of the underlying technology. After a short introduction to the terminology, a map of the potential blockchain has for society is sketched. The text also debates the decentralization aspects of the technology and the challenges it poses for individuals and organizations. Later, the storytelling aspects, as well as some religious aspects within and around the blockchain community are analyzed. Finally, some thoughts about adoption scenarios are laid out, and some ideas why blockchains have become very important in Switzerland are formulated. The focus of this text is on the opportunities and strengths of the technology. It deliberately oversimplifies the technological aspects in order to focus on the implication of the technology on society.

Blockchain—etymology

The term "blockchain" and Satoshi Nakamoto's whitepaper on bitcoin[1] are often associated with each other. Yet the term "blockchain" never appears in the paper that sketches the characteristics of the data structure associated with blockchains. The bitcoin white paper refers to a "chain of blocks", and only in late 2008 was the term "block chain" in two words used in a cryptography mailing list to refer to the data structure Satoshi Nakamoto had described. However, the term "block chain" was used in a similar way as early as in 1997 in mailing lists, but it did not relate to the data structure bitcoin represented. These mailing lists were connected to the cypherpunk movement in the bay area near San Francisco. The topic of the discussion was a tool that was created to reduce spam mails. The cypherpunk movement can be seen as the community that generated the debates about society and technology that made blockchain technology possible in the first place.

In this context, it is worth mentioning the cypherpunk manifesto, written by Eric Hughes in 1993. It shows that the origins of the cypherpunk movement were related to privacy in an open society in the digital age and about the possibility of creating transparency.

"Privacy is necessary for an open society in the electronic age. Privacy is not secrecy. A private matter is something one doesn't want the whole world to know, but a secret matter is something one doesn't want anybody to know. Privacy is the power to selectively reveal oneself to the world."[2]

Blockchain—the context

The blockchain as a phenomenon can be seen and interpreted in the light of the digitalization process of the world. Since the 1950s the planet has been getting more and more digital. There are many ways to structure and enumerate these waves of digitalization. We propose to enumerate the waves of digitalization relevant in the blockchain context as follows:

The first wave is represented by the digitalization of information facilitated through the introduction of the internet. The second wave is the digitalization of community building and communities through social media. Finally, the third wave is the digitalization of value with the introduction of blockchain and distributed-ledger technologies.

[1] https://bitcoin.org/bitcoin.pdf.

✉ Toni Caradonna
toni@caradonna.ch

[1] Bern, Switzerland

[2] https://www.activism.net/cypherpunk/manifesto.html.

Looking at waves 1 and 2, I will identify similarities and compare them with the development of the current third wave that is represented with blockchain. I will show that this third wave could bring back some features relevant to society that have been washed away by the first two waves.

Digitalization, decentralization and disintermediation

The narratives around blockchain technology have similar traits to the narratives and developments in the early days of the Internet and of social media. It is the narration of a new promising technology with an enormous potential for disruption that enters the world to make it a better place.

The elements that are relevant and similar in all three digitalization waves are: decentralization and intermediation. In the three digitalization waves, internet, social media and blockchain, we can see a first phase of digitalization that is connected to a physical disintermediation, which leads to a decentralization. Later the pendulum swings back, bringing a centralization element based on a business model that is built on top of the technological innovation. Usually the added value that the centralized platform models brings is a combination of convenience and added value through networking scaling effects. While it is possible to have a decentralized lifestyle in a centralized environment, users usually have to make certain tradeoffs: privacy and autonomy for convenience, freedom for the access to mediation services. This dynamic nature of the digitalization processes in the centralization versus decentralization spectrum depends on a variety of factors, which will be highlighted later in this text.

Digitalization of information—the Internet

The first wave of digitalization that hit mainstream society heavily was the digitalization of information. With digitalization of information and the availability of the Internet, information has been disintermediated from books, teachers, universities, libraries, institutions and authorities of all sorts. Information can be multiplied, altered, shared and distributed with very few transactional costs. The digitalization of information and the disintermediation from the physical representation of information enables users to act independently from the origin or the creator of the information. Access to information and the possibility of trading and creating commerce has improved drastically.

Back in the 90s the internet was a big promise of a better world. The utopia is probably best condensed in the declaration of independence of cyberspace[3]. In its early days, the Internet was the promise of a shared network of individually owned servers and domains in which everyone participates equally, a decentralized web that would empower people. There were promises, dreams and expectations of freedom, independence and user-centric lives. Promises over ownership over data. However, we have to face the reality that we woke up in a cyber-dystopia, a quasi-totalitarian digital world that is dominated by companies that are more powerful and have more influence on society than many governments. We must face the possibility that technological advancements have made the world worse. In cyber-dystopias, individuals lose control, become dependent and are unable to stop the change that is happening. Even Tim Berners-Lee, the inventor of the Internet, is calling for action and working on a project to bring back the decentralized aspect of the Internet that should empower users.

This first wave of digitalization where the Internet increases access and proliferation of information is creating a tendency towards information symmetry. On the other hand, control over digital information is very hard to handle. It is difficult to keep ownership over data, e.g. copyright, user-generated data and sensitive data that is meant to be private. It is also difficult to keep track of data iteration and the origin of data, and it is difficult to keep data access restricted. Last but not least, the disintermediation of data from the physical world creates a challenge when we talk about identity. In a globalized and digitized world, we depend heavily on trusted third parties to navigate, act and interact in the digital world, and we must trust those parties when we organize cooperation in our society.

In terms of adoption of this first wave of digitalization, we can see parallels to what is happening with the adoption of the blockchain technology. The innovation arrives, but nobody knows how to use it or how to generate business with it. Typically, a business model is not necessarily connected to a feature of the technology it uses. In the first wave of digitalization, the business models that were most sustainable directly opposed the features that the technology offered and the utopia promised. Centralized services created additional business value through monetization of information and through making services and applications more convenient. Exactly this centralization that was needed for the success of the business models ended the marvelous utopian ideas created by the technology in its early days.

Innovation adoption is often solution oriented and influenced by the cognitive bias that involves over-reliance on a familiar tool, which is illustrated by Maslow's hammer [1]. With the advent of innovation, society has a new tool but needs an ecosystem and infrastructure around it. New technology needs a legal setting that supports it and education on how to handle it. All these processes need time and, ideally, a debate within society. Eventually, then, these debates and processes will decide whether or not the feature

[3] https://www.eff.org/cyberspace-independence.

that a technology offers can be implemented. The invention or discovery of technology itself does not at all mean that its features can or will be used.

Digitalization of communities—social media

If the Internet was the digitalization of data, social media is the digitalization of communities and community building. In analogy to the first wave of digitalization disintermediation has several effects. With the advent of social media communities do not have to physically gather or use physical intermediaries or tools to interact. Again, the process of disintermediation allows a physical decentralization of communities by mapping communities and their interaction digitally. The acceleration that this disintermediation allows is more convenient and easier to access than traditional community building tools. It generates added value for users and the owners of these digital tools through network effects. Social media tools were perceived as an enabler for bottom-up movements that can change society. However, again, this utopia ended up in dystopian frustration with social media being used and abused for controlling and influencing society. Further, because these tools are based on a business model that incorporates a central intermediary, it also means that users have to both trust, and finance this intermediary third party directly or indirectly.

When looking at community-building tools, one of the key issues is the identity of community members and the role of an identity. In the digital world, this translates to access control and digital identity that still is a challenge in our digital world. In a large part of the world, users delegate many processes, including identification and payment services to the "Big Five" Google, Apple, Amazon, Microsoft and Facebook, and we accept them as trusted third parties when we interact with one another digitally. By doing so, users give away power and means of control over the data and metadata they create, and they give away power over the structure of the digital community.

Also, we still have the problem generated from the first wave. The problem of continuity, origin and authenticity of digital data. Combined with this second wave of digitalization we create a new challenge. An army of bots, algorithms and virtual digital identities influence us and our perception of the world, and even influence processes in our society like voting.

With the internet and social media, we now have two tools for society to act in the digital realm. Looking at the problems mentioned above, society might need a third tool that solves all the problems that were created in the first place. A tool that brings back control over data, a tool that can create and ensure transparency and authenticity, a tool that can bring privacy in interactions.

What if we could think of a digital interaction and cooperation tool that puts the user in the center? A tool that enables users to interact with one another securely without the need of a trusted third party and without the need to trust each other. A tool that puts the users in the center and not the platform or the company that runs the platform. A tool or model that empowers the user and not the organization running the platform, or even a model, where the users cooperate to run the platform. A model where users have control and ownership over value they agree on, over data they generate and transact, as well as control and sovereignty over their digital identity.

Welcome to the Blockchain—Utopia, which brings back to us what we lost when the Internet and social media were created.

Digitalization of value—blockchain technologies

While the Internet was about digitizing information and social media was about digitizing communities, the origins of blockchain technology were about digitizing value and creating a decentralized network to map and transfer value independent of trusted third parties. Blockchains address a very specific problem: the problem of digital continuity. Before blockchain technology, digital continuity could not be guaranteed without the help of a trusted third party. Anyone could copy and paste data and multiply it; there was no way a user could keep track of data changes. With the advent of blockchain technology, this is now possible. This will have many implications that we will only slowly start to understand. It means, for instance, that digitized assets could become independent economic agents. We can now keep track of data alteration and create transparency in dataflows. It enables something that simply could not be done before the advent of this technology.

Blockchain technology triggers similar utopian dreams to the two first waves of digitalization. Unfortunately, in the blockchain technology adoption, we see a similar backlash to in the two other digitalization waves. The real innovation of the new technology wave—empowerment of participants through disintermediation—is undermined by additive layers and business models that create centralized structures.

Digitalization challenges

There seems to be little awareness for the fact that digitalization created new and relevant challenges on a global level. There is no or little awareness that digitalization resulted in an accumulation and centralization of power and influence beyond most people's imagination. The centralization of the digitalization processes brings certain standards, which, in turn, brings a certain level of convenience.

Further, because convenience seems to be the tradeoff for handling value, it is not clear whether mass adoption of blockchain technologies is possible to implement on a peer-to-peer level in society.

The fact that society needed trusted third parties in the non-digital world when cooperating on a large scale created two things. It created large organizations that did accumulate a certain level of trust on the one hand. Moreover, it created large communities that are used to interacting with one another other through trusted third parties. As consequence, many ecosystems could be established with checks and balances that ensured sustainability for these trusted third-party ecosystems. On a personal and human level, the need to trust someone might be a fundamental human trait or need that cannot be overcome by rational arguments. As consequence, the concept of trusting an algorithm or a technology might be hard to communicate, hard to explain and hard to do as a human.

Users or organizations might be incapable of handling the technology and need third-party support and/or education. Third-party support is usually structured and organized by a business, which, in turn, is interested in keeping a certain degree of control and power.

In order to avoid that, you have to handle responsibility, and as a user or organization you need three things. Knowledge and knowhow to understand and handle the technology, a sense of responsibility and the willingness to act upon it and, finally, a user or an organization needs a certain frustration tolerance to cope with the efforts that come with behavioral changes associated with changes of paradigms.

Probably the perpetual conflict and the balance-finding process between decentralized tendencies versus cooperative processes that drift towards a certain degree of centralization will always be dynamic. However, for now, we find ourselves rather on the dystopian side of a centralized digital world. We have to suffer the consequences of poorly-managed centralism, which include massive data breaches, crippling financial crises, digital propaganda and global tax competition.

Digitalization summary

All three digitalization waves above started with the use of a technology infrastructure designed for a decentralized, digital world that would empower users. We see tendencies that the digital tools built on the infrastructure still quite often function in a centralized manner. Since we are still in the very early phase of the third digitalization wave, we still have the opportunity, and I may say responsibility, to actively decide on how to adopt the blockchain technology. Probably, the challenge is not in the technology but in educating the user, in creating a sense of citizenship, in provoking an active decision and avoiding the scenario, where the desire for convenience prevents knowledge about the technology and prevents a conscious decision.

Or as Paul Goodmann [2] puts it: “Throughout society, the centralizing style of organization has been pushed so far as to become ineffectual, economically wasteful, humanly stultifying, and ruinous to democracy. The only remedy is a strong admixture of decentralism. The problem is where, how much, and how to go about it” [2].

What is blockchain?

Despite normative and descriptive efforts in defining terms and definitions, the consensus about “blockchain” and “distributed ledger technology” (DLT) taxonomies and ontologies is only slowly being reached. However, when comparing literature [3–5] a wide range of coexisting inconsistent definitions can be observed. Since there is an economic potential in blockchain and DLT applications, the dispute within several standardization authorities is being fought very fiercely.

What is important to understand is that a blockchain is nothing but a data structure. The problem the bitcoin whitepaper tried to solve was the digitalization of cash. That leads to several problems. If you have a digital representation of some kind, a dataset, a picture for example, you can easily duplicate that dataset and have two digital representations, two identical datasets, two pictures. Obviously, this is something you want to avoid when digitizing cash. So, how can you ensure that you cannot simply copy and paste a bitcoin and multiply the number of bitcoins on your computer?

Of course, a central authority could run a ledger listing all transactions and ensure that participants do not tamper with the dataset. However, the bitcoin whitepaper was written as a reaction to the 2008 financial crisis. The ambition of the anonymous author publishing the whitepaper under the pseudonym Sathoshi Nakamoto was to create a peer-to-peer electronic cash system that is independent of trusted third parties like banks. If you had a centralized solution of some kind, you would need to trust that party. The consequences of trusting a third party are manifold. A centralized solution creates a honeypot for attackers, and you would need confidence that the trusted third party can handle security issues because a centralized solution is also single point of failure. Furthermore, a centralized solution cannot prevent that a payment is reversed, and the central authority would receive the power to control, stop and or alter transactions. Finally, a centralized solution has the power over decisions like creating or reducing inflation by regulating the amount of cash in the system. You could argue that a centralized solution creates higher costs because of the intermediaries

and would put users at the mercy of decisions of centralized institutions like central banks.

The technology that solves this trust problem is a peer-to-peer network with a decentralized distributed ledger. It delegates trust from trusted third parties to algorithms, and the control over the infrastructure is in the hands of the peers. The decentralized distributed ledger ensures that a peer does not spend more than he has or that he does not reverse a transaction. Because every participant has a copy of the ledger, and the ledger lists the history of all transactions, a single peer cannot pretend to own more bitcoins that he has. To oversimplify again: copy/paste of a bitcoin is not possible because if a bad actor tries to cheat in his ledger, all the other peers with a copy of the ledger would disagree with the bad actor's version of the ledger. The majority of the peers decide what version of the ledger is the valid history of transactions.

The decentralized peer-to-peer database solution solves the trust problem. However, it creates other problems. How do the peers decide which transactions are stored? What majority-decision processes would you implement? How can you ensure that bad actors do not create majorities by simulating additional peers representing the bad actor's version of the ledger? How do you incentivize peers to run a such a digital ledger? Most importantly: how does the network ensure consensus is reached within a group of decentralized peers in a digital network that is not synchronized by a central authority? Bitcoin solved all these problems using a consensus algorithm called Proof of Work. This algorithm is designed to force participants to act fairly in order to participate at all. The mechanism itself relies on cryptographic techniques. For the scope of this text, it is not important to understand the mechanism of this algorithm. What is important is that this algorithm takes time and consumes energy. What is also important to understand is that there are other consensus algorithms that do not consume that much energy or time. However, in order to implement them, you would need to make certain tradeoffs.

Three generations of distributed ledgers

As was mentioned before, there are different ways to solve problems that are created by decentralization. On the metalevel, three elements are relevant when we look at distributed ledgers. First, we need some kind of structure as a database. Second, we need some instructions for handling that database structure, usually referred to as consensus mechanism. Finally, we need some motivational tool for peers to participate. That motivational tool can be a native intrinsic asset like a bitcoin reward for successful cooperation. However, the motivational aspect for participation can be well outside the database construct itself. In the scope of this text, we will not look into the motivation tool aspect at all.

The database structure can be a chain of blocks that registers valid transactions. However, a database can have a different structure, so blockchains are only a subset of the family of distributed ledger's technologies. For the sake of simplicity, I will refer to blockchains or blockchain technologies to indicate community consensus-based distributed ledgers in general. So, blockchains can be designed in different ways and can be adopted to the problem they are trying to solve. The development of designing different blockchains can be structured in three generations. The first generation of blockchains enabled digital cash, with bitcoin being the first cryptocurrency. Several variations were created, each of them being a decentralized peer-to-peer network solving digital currency-related problems.

The second generation of blockchains created the possibility of having a programmable blockchain that enabled the implementation of business logic into a decentralized system. You could oversimplify again and say: Why should we have a multitude of networks all creating slightly different cryptocurrencies? Is it not possible to have one network, one infrastructure that allows programming, and one of these program types could be a cryptocurrency?

Programs that run on a blockchain are often called smart contracts. The idea was first mentioned by computer scientist and former law professor Nick Szabo in 1997 [6]. It is a term that became popular when Vitalik Buterin, the inventor of Ethereum, adopted it. Smart contracts are agreements enforced not by law, but by hardware or software. However, translating the term "smart contract" into "program on a blockchain" can help to read certain literature but hides the revolutionary fact that in a smart contract, the contract itself, as well as the elements of the contract are in the same channel. If you compare this to the analogue world, it is not possible, you cannot have an executing piece of paper, you always need to involve trusted third parties for execution or enforcement. In the digital world, contracts either fully execute or do not fulfil the agreed conditions and do not execute. With smart contracts you can prevent two situations: first, the situation that only one party fulfils the contract, and second, you can prevent that either party only fulfils the contract partially. So, for objects that can be represented digitally, smart contracts significantly reduce litigation costs and increase confidence.

The third generation of distributed ledgers moves away from chains of blocks as a database. Typically, third-generation blockchains allow better scalability in terms of transaction volume and/or the possibility that certain branches of the distributed ledger are disconnected. It is important to know that first and second-generation blockchains do not scale very well. Bitcoin and Ethereum, for example, currently allow an order of 10 transactions per second, 7

for bitcoin and 15 for Ethereum. If blockchain technology wants to solve problems generated by the first and second wave of digitalization, blockchain technology needs to scale significantly.

However, in order to enable the scalability in numbers of transactions or to allow the disconnection of branches, there is a tradeoff. Typically, third-generation blockchains are not chains of blocks but are rather structured like meshes or tangles.

On the metalevel, there are protocols that try to connect several blockchains with each other and allow interoperability of several blockchains. A functional and user-friendly interoperability of blockchains would bring enormous benefit to the blockchain industry. Since blockchains have scalability issues and are typically designed for a specific problem, interoperability would allow both an extremely high scalability and flexibility in implementation.

Various types of blockchains

We have seen that there are three fundamentally different generations of blockchains. However, each type can have different specifications again. In order to understand the diversity of blockchain tools it is helpful to look at a few varieties of designs. We will establish a terminology and potential advantages and disadvantages of the specific designs along the way.

Brewer's theorem, or the CAP theorem, is a central element in theoretical computer science, which states that in a distributed system of nodes, it is impossible to simultaneously have more than two out of the three following guarantees or properties [7]:

- *C: consistency*—At any given time, all nodes in the network have exactly the same (most recent) value.
- *A: availability*—Every request to the network receives a response, though without any guarantee that returned data is the most recent.
- *P: partition tolerance*—The network continues to operate, even if an arbitrary number of nodes are failing.

Blockchains and DLTs are distributed system and, hence, have to cope with the CAP theorem. Blockchains are systems where nodes can fail at any time because users cannot be forced to participate. Of the two remaining options, bitcoin chooses availability over consistency. Yet there are other ways to design a blockchain that have other priorities. What is important to understand is that there are different ways to design a blockchain system. Depending on the design, we have different advantages and bottlenecks.

In the bitcoin blockchain, all participants can read the entire ledger; all participants are allowed to validate transactions and write them into the ledger, the transaction history is visible. However, other settings are possible. Here is a list of terms that seem to have some validity and consistency in the blockchain community:

- *Permissioned:* restricted write OR restricted validation permission
- *Permissionless:* public write permission AND public validate permission
- *Public:* public permission to participate in the consensus process
- *Private*: restricted permission to participate in the consensus process
- *Privacy:* obfuscated traceability.

Sometimes, terms like federated blockchain or consortium blockchain, are used, but these terms have a wider definition-variability within the blockchain community. They often refer to permissioned blockchains.

Between scalability, security, and decentralization, a tradeoff needs to be made. Public blockchains have sacrificed scalability, whereas permissioned blockchains sacrificed decentralization for security and scalability. Privacy blockchains allow us to create transactions that cannot be traced back to addresses.

Depending on the problem that is addressed, a thorough evaluation of advantages and risks needs to set up a blockchain or use an existing blockchain infrastructure.

Two ways to look at blockchain

No matter how we define the technological design and the applications of blockchain technology, the technology creates two shifts in paradigm: from "trusting humans and third parties" to "trusting machines, process design, and mathematics" and, second, from "centralized" to "decentralized" control [8]. As a consequence, there are two ways of looking at a blockchain. The technology has a disruptive potential from both an information and communication technology (ICT) perspective and an institutional perspective.

First, it can be seen as an ICT to record data and provide access to it. This data can be any data really. Being decentralized, the disruptive potential of it lies in the fact that participants do not need to trust the owner of the database. The reason is very simple. Participants themselves organize and run both: the database and the governance of the database. Each participant has a copy of a database, a so-called node. Hence, participants need only to trust their ability to handle data or code. Moreover, as mentioned earlier: when users do not need to trust a third party and reclaim control and ownership over data and data governance, they also inevitably regain responsibility. On the one hand, not everyone wants that and, on the other hand, not everybody can handle it. Very often, the price of responsibility is convenience, and

ultimately, this could be an important threshold for acceptance.

Second, it can be seen it as an "institutional technology" to decentralize governance structures used for the coordination of people and economic decision-making as well as for enforcing transparency [9]. From this perspective, the interpretation of data and the interaction of the digital data with the physical world is relevant. Here, the blockchain technology is about rights/obligations arising from agreements that can be mapped with blockchain data. It is about interpretation of data as a mapping process of what happens in society. Here, we talk about currency aspects, ownership rights, copyrights, digital identities, credit exposures, and tracking of goods and services. This second aspect of blockchain, however, creates other relevant problems, namely:

The oracle problem: how do we get data from outside the blockchain into the blockchain? When we do have a digital representation of some sort within the blockchain, the question remains: how that representation entered the digital world, what authority, person, organization, or interface created the digital representation within the blockchain. There are several approaches to cope with the oracle problem that are not elaborated here.

The enforcement problem: what if we do have consensus within the data, consensus in the interpretation of the data but nobody to enforce the consequence of the interpretation? Again, here we see a dilemma when looking at decentralized, disintermediated digital structures in a physical word, a digital representation of a society with a local jurisdiction and structure that needs some sort of eventually central coordination.

The interpretation problem: what if we have consensus within the data but miss consensus about the interpretation of the data? This problem is more subtle but will be of greater importance when blockchain technology becomes more prevalent.

Blockchain narratives

Storytelling and religion both shape society. They both help establish group identity, moral code, and social norms in a community. Nobel prize winning economist Shiller [10] shows 2017 how epidemiology of narratives influences economic fluctuations. He shows that stories motivate and connect activities that spread and have an impact, like the Depression in the 1920s, the Great Depression in the 1930s, and even the so-called Great Recession of 2007–2009. Being humans, our actions are not solely rational, as we will see in a separate section about game theory. The sum of the nonrational actions can be interpreted by looking at the storytelling aspect.

Technological developments are usually wrapped in stories or narrative structures that are not only technical. The technology in the narration also encompasses collective ideas of how we should build our society, our institutional reality. Blockchain technology, however, is not merely used as an object in narrations. Peer-to-peer technologies do more: according to Agre [11] they configure the narratives through which we understand our social reality.

The storytelling aspect of blockchain

Looking at the genesis of bitcoin we have excellent elements of a good story. An interesting setting: the world on the brink of collapse during the 2008 financial crisis. An interesting character: Satoshi Nakamoto, the anonymous genius author that gifts the world with this new technology. An ongoing complex plot with conflicts between the community and outsiders, as well as conflicts within the community.

The narrative aspects of cryptocurrencies are elaborated in detail by Reijers and Coeckelbergh [12]. The most compelling point in the narration, as well as in the technology itself, is that cryptocurrencies and blockchain technology are "weapons in the new control society" [13]. This is interesting when comparing the cryptographic software developed in the early 1990s, the cypherpunk movement context, and the fact that also the cryptographic software PGP was legally considered as a weapon in the United States of America and investigated for *munition export without a license*.

Storytelling allows the propagation of a complex technology, it allows us to propagate the effects and the power of the technology, and creates a community sense for the adopters. The community bonds in the blockchain community can be very strong; they can be so strong that we could look at it from a religious aspect.

Religious aspects of blockchain community

Similarities Both blockchain and religion create irrational disputes; their respective followers will make considerable sacrifices. There is often a powerful sense of belonging to a movement with its own code. There are heroes and leading figures, followers, and even a glorified messiah—the story with the mysterious Satoshi Nakamoto and the barely 18-year-old prodigy child, Vitalik Buterin, who invents an entirely new, programmable blockchain concept. Another example of a savior-like character is Roger Ver, the promoter of Bitcoin Cash, who speaks of himself as Bitcoin Jesus. There are sacred texts in the blockchain community, like the bitcoin whitepaper. Ritual celebrations, events, and gatherings like the bitcoin pizza day, the reward-halving events in bitcoin, and the developer conferences that are important

moments in the lives of blockchain followers. Then, like in religions, there are schisms also in blockchain communities. Typically, what happens in a blockchain-schism is that a change to a blockchain code is not accepted by the entire community. So, both the community and the blockchain code split. This digital blockchain-splitting process is called fork. Of course, what is important for the marketing and storytelling momentum of the blockchain movement and religions are the miracles. Stories would gravitate about the idea that a miracle happened with blockchain, everybody has seen and experienced it. In the perception of many inside and outside the blockchain world, money has been created out of thin air. There is a monetary value and a market for decentralized projects without a company or juristic body running it, and only the community keeps it alive. Another miracle story is propagated: that of the powerless individual person or oppressed organization that has received a tool to be independent, empowered. A storytelling element that is dominant in the WikiLeaks history. Every organization and even ordinary people with a computer can be part of a bigger picture, possibly a revolution that helps setting up a new order of the world. So much for the conceptualized mindset of the blockchain enthusiast in the last decade.

Criteria There are several ways to define what a religion is. There is the functional definition. It does not focus on what a religion is, not on beliefs and practices for example. However, it focuses on the effect of the religion, on what the religion does for the individual, the group, and on the needs the religion fulfils. A religion, for example, can provide or contribute to bonding, identity comfort, and security. "A system of beliefs and practices by means of which a group of people struggles with the ultimate problems of human life." [14, p. 7].

On the other hand, there are substantive definitions that are more narrow and closer to common-sense perception and to what ordinary people mean when they talk about religion. An example of such a substantive definition would be "Religion, then, consists of beliefs, actions, and institutions which assume the existence of supernatural entities with powers of action, or impersonal powers or processes possessed of moral purpose" [15p. ix].

Synthesis Similar to football, blockchain and its community offer social and psychological functions that would allow football and blockchain to fall under the functional definition of religion. Yet the question remains, whether being active in the community is a religious activity. Personally, I think both the storytelling and the religious aspect that can be observed in the blockchain community are a reaction to the technical complexity. The simple, irrational explanations based on feelings and opinions in combination with the power of storytelling elements allows us to cope with a technically complicated tool that is designed to empower an individual. Furthermore, storytelling allows us to propagate blockchain technology as a tool without using blockchain, without fully understanding it and without the effort of crossing the adoption threshold that is induced by the powershift to the individual. With storytelling and community experiences users can contribute to the idea and be supportive of it without the strenuous act of either understanding it intellectually or handling it on their devices.

Added value to society and potential impact

Blockchain technology can be understood and interpreted as a tool in the context of digitalization processes. It can enable the decentralization of digital processes and, consequently, both provide privacy and enforce transparency. It guarantees immutability of datasets and can enhance security.

The decentralization it enables is only one feature that this technology offers. Even though technology is being appropriated by ideological movements and shows aspects of a functional religion, it offers unique opportunities. The main opportunity is that it enables us to debate openly on what kind of digitalization process we want to have. How we want to handle the disintermediation that is created because of the technology. Before the advent of blockchain technology, we could not debate the position we want to represent in the centralization versus decentralization spectrum, because the utopian promises of both the Internet and social media ended up in dystopian realities. Now we do have a chance to actively and consciously debate. Also, we have the opportunity to educate the next generation in our society, so that they can decide consciously how they want to map the digital representation of society and what kind of tradeoffs they are willing to make.

The impact of the technology itself is that it provides a fundament for creating peer-to-peer networks for sharing, exchanging, and trading digitized information, goods, and assets. This can have an impact on services, business, and regulation. Instead of a comprehensive list claiming completeness, I will focus on a few use cases that I encountered as an active member of the blockchain community.

Blockchain adoption and game theory

In certain settings, information asymmetry or intransparency is a desired state because it creates profits. If we look at a set of incumbent market participants that have either few pain points, or are not agile or are highly regulated, then there is little opportunity for change in any direction. In an industry of established, incumbent players, nobody needs to act and offer transparency as an added

value, as long as nobody else acts. If we are in an industry or community where agile players have high regulatory thresholds, blockchain adoption is unlikely. Game theory findings show that there are some fundamental challenges to the adoption of blockchain technology [16]. In essence, game theory describes how actors rarely make decisions based only on reason and rational thinking. So, if the technology is being marketed with the rational aspect ignoring the human elements, then the adoption threshold is higher. Trust is a highly emotional element based on experience within a community. So, the shift from this highly emotional experience to machines and algorithms is a challenge. There is the possibility that trust is not something that needs to be delegated in some societies. Also, being a decentralized coopetition structure, it is hard to find a central authority organizing common efforts. A fractionalization of the community is likely to happen and can currently be observed in the blockchain space.

Operational efficiency through immutable and distributed record keeping

Depending on the particular use case, blockchain technology can reduce costs and improve efficiency. Blockchain challenges the logic of information silos between market participants, and it can reduce the need for interfirm reconciliation. If assets are represented digitally, smart contracts have both the content of the contract as well as the contract itself in the same channel. They either execute both or none. Also, they only execute fully and never partially. As a consequence, as seen before, litigations can be reduced drastically provided that the content of the contract can be represented on a blockchain.

Blockchain introduces the concept of proof-of-existence or proof-of-nonexistence over events. Since blockchains provide a historically structured database that has community consensus, they can certify the authenticity of documents, digital or digitalized assets, licenses, or certificates at a given moment. This feature will have an impact on notarial services. Of course, the impact of such tools will only be relevant in a regulatory setting that accepts digital identities, digital representation of ownership rights, and digital signatures that are accepted by the authorities.

Blockchain technology not only provides an infrastructure for creation, transfer, and programming of digital value, it can also protect digital value from counterfeit, illegal, and/or uncontrolled duplication. This could be game changing in sectors like the arts, where digital artefacts were hard to protect before the advent of blockchain technology. Evidently, the finance industry must rethink its role. The postal service did not disappear with the invention of emails, but it had to reconsider its role. Similarly, blockchain technology will not make banks or insurances disappear, but they have to reconsider their role and position, as well as the value proposition they offer to clients and society.

According to the World Bank, emittances from abroad are major economic assets for some developing countries. By being more efficient, faster, and less costly blockchain technology can improve the situations of people in the world that need it most and can create additional benefit in places in the world where small changes have a big impact.

Based on the decentralized peer-to-peer infrastructure combined with low transaction costs financial inclusion is easier to implement with blockchain technology. Globally, 1.7 billion people are still unbanked, yet two-thirds of them have access to a mobile phone[4]. The upside is an undeniable potential for improvement, particularly because financial intermediaries in developing countries often have trust issues. On the downside, there is an ongoing debate whether the blockchain approach does not widen the already existing gender gap in financial inclusion [17]. The approaches enable to blockchain-based financial inclusion are complex but can be structured in four dimensions

- Inclusion through blockchain-powered economic identity
- Blockchain-powered services for refugees and migrants
- Inclusion through blockchain-powered remittance services.
- Blockchain-powered digital identity for citizens in poverty

The most obvious reasons why blockchain-based applications make sense in this context are the low costs and fast settlement. There is no need for branches of a financial intermediary, the payments are digital, the fees involved are low, and most importantly, micropayments are possible.

Information symmetry through transparent record keeping

Information asymmetry has an influence on trade and negotiations. It is causing problems like moral hazard and adverse selection. Historically, such problems were solved by central authorities that are a single point of control in good times and have the potential of failure in bad times. Furthermore, there are challenges in traceability and little transparency in accounting, which increases the need for regulatory intervention. Introducing a shared transparent ledger should increase the cooperation between regulators and regulated partners. It has the potential to move from post-transaction monitoring to immediate or on-demand monitoring and intervention. The reliability and rep-

[4] https://www.worldbank.org/en/news/press-release/2018/04/19/financial-inclusion-on-the-rise-but-gaps-remain-global-findex-database-shows.

utation of actors in a system can be verified and monitored. Ideally, we will see a convergence of industry and government interests, which will reduce regulatory compliance costs.

Using blockchain technology to create transparency and efficiency in the donation or philanthropy market seem to be a use case. However, from what we see in the donation space, donors still seem to care about trusted institutions and brands that vouch for projects and guarantee project delivery. Donors and philanthropists seem to be willing to pay a premium to delegate trust to an institution. The transformational effort for an NGO from a value redistribution organization to a knowledge handling organization that is associated with a blockchain-based value sharing infrastructure seem too-big a threshold tackle. However, there is an opportunity for donation-dependent entities to streamline their processes. Today, as little as 20% of donations actually make it to the intended recipients. The rest is eaten up by the infrastructure and the intermediaries in the value transfer chain.

Decentralized corporations and governance

Our societies are centralized to a certain extent, and institutional hierarchies govern the activities of our socio-economic life. With the automation potential of the second-generation blockchain and the scalability potential of the third-generation blockchain, we can now think of new processes. We can imagine unique and secure digital processes that can self-execute, self-enforce, self-verify, and self-regulate in a decentralized network. This allows the creation of new organizational structures in a society. It allows the creation of self-organized economies and decentralized autonomous organizations (DAO) that enable new models of nonhierarchical cooperation, coopetition, and governance, where decision-making happens throughout the network and not in the center. An important DAO that was created on the Ethereum Blockchain, its failure, the debates about the role of code, the role of community, and the legal aspects, as well as the consequences it had on code and community are worth further reading [18].

Aligning incentives to reduce the tragedy of the commons

Smart contracts have the power to lock value and only release it if certain conditions are met. This allows an alignment of stakeholders with nonaligned interests. If the stakeholders do not cooperate or find compromises, if they do not align their value to a certain extent, then the value locked in the smart contract is lost. Creating such settings allows the incentivization for competitors to cooperate in areas where they disagree and ideally create an antifragile system. The concept of coopetition is where a community has more to gain when they approach a status that has both elements of competition and cooperation. Examples of coopetition could be drivers of carsharing services like Uber. The drivers compete, but the service is only useful and chosen by consumers because there are so many of drivers. Another example of coopetition is participants running a mining node in a bitcoin network. They compete to generate the next block and receive a mining reward. The value of the network and the reward heavily depends on the size of the network.

Environmental and natural resource problems are associated with overexploitation or underprovision of public goods. This is an important area where blockchain-supported coopetition incentivization can offer a solution space. Overfishing, excessive air pollution, unwarranted extraction or diversion of ground or surface water, and extreme depletion of oil and gas reservoirs are examples of the tragedy of the commons where private decision-makers do not consider or do not internalize social and environmental benefits and costs in their investment or production action. The gap between social and private net returns results in externalities that have harmful effects on third parties.

Blockchain technology is key when there is a need for a transparent, decentralized and/or distributed coopetition setting where stakeholders need to cooperate in the long term in order to create a sustainable and stable system.

In Romania in the Carpathian Mountains, a blockchain-based ecosystem is planned to implement exactly such a solution. It is a cooperation between WWF Panda Labs, the Swiss Porini Foundation, and ETH Zürich. They are planning a blockchain-based circular economy that tries to create a coopetition setting around the project. In the center of the project are the communities in the ecosystems affected by the rewilding of the wisent, the European bison.

Blockchain support for public services and digital citizenship

The world is being digitalized more and more, and we have to accept the fact that many countries have a critical information technology (IT) infrastructure that needs to be protected, a critical infrastructure that is accessible in a world populated with objects that are directly connected to the Internet. These IoT (Internet of Things) devices are vulnerable to cyberattacks. Centralized IT structures add to the danger, since they may a have singular points of failure or represent honeypots that make such targets even more attractive.

On the other hand, looking at blockchain from a governmental perspective most probably involves a fear of loss of power moving away from central authorities to self-governed peer-to-peer structures.

However, new forms of participation and relationship between government and civil society are possible and could add or create value for both, the society and the government. Blockchain technology could manage, handle, and trace processes and operations like identity management, tax collection, service distribution, national digital currencies, and any type of government register. At a first glance, advantages could include the simplification and standardization of internal processes, the reduction of transaction costs, more reliable interactions and exchanges of data with other organizations and governments, and greater protection against errors and falsifications. Yet most probably, the relevant value creation would be realized when new radical tools or processes are enabled. Let us imagine a digital citizen-centric identity solution, where the state is still the authority confirming identity, but the citizen has the control over the digital representation. A bit like he has over a physical passport, really. Or let us try to imagine more granular or even liquid government services. A process like liquid voting or a hide-and-reveal voting process, where a citizen can check whether his or her vote counted. To decentralize and digitize services through blockchain technology does not mean dismissing the state, but to promote good governance. In doing so, civil society could protect its interests more effectively. Now both blockchain technology and the digitalization of political processes are in the very early stages. In many cases, legal ownership of assets is connected to a physical piece of paper. Probably it is too early to think about blockchain-enabled liquid voting. It probably is a smart strategic decision to wait until some incubation time has passed so the technology itself can be tested and users can learn to handle the technology.

Adoption challenges and scenarios

Blockchain started with bitcoin, a decentralized peer-to-peer payment system as a reaction to the financial crisis in 2008. Now, 10 years later, we may ask two questions: can blockchain technology provide an alternative payment solution? Here the answer clearly is positive. The more interesting question, however, might be: is there a need for an alternative payment system? Looking at Occam's razor, the problem-solving principle that favors the simplest solution, we may doubt whether blockchain payment systems will reach widespread adoption. On the other hand, if a new financial crisis should appear, there are now new alternative tools that can be used. Maybe, the fact that there is an alternative technology available for independent value transfers, creates the antifragile situation that keeps the traditional financial system more stable.

In the first 10 years of blockchain technology many use cases were developed. One of the major reasons why the technology has not been widely adopted yet is very simple. The creation of laws is always delayed compared to the technological innovation. However, since blockchain technology is about digitalization of value, and the regulation density in financial markets is very high, there is much insecurity involved in the adoption of this technology. This insecurity creates high risks that incumbent organizations are not willing to take in the short term, and agile organization cannot take in the short term, because of the regulatory thresholds.

Adoption through blockchain ecosystem networks

Optimistic blockchain experts predict that the concept of blockchain ecosystem networks will be the new dominating business model of the future. The average lifespan of S&P500 companies has dropped from 61 to just 18 years in past 60 years[5]. Nowadays, 50% of global annual company revenues come from products launched within just the past 3 years. How can we interpret these figures? Before the year 2010, dominant businesses used to make business on resources, products, and services. However, new business models have drastically changed the landscape. Platform businesses started taking over in 2010, where value is generated facilitating exchange between interdependent groups, usually consumers and producers. Later, around 2015, exponential organizational models like Uber and Airbnb took the lead. These exponential organizations create output from owned assets in a sharing economy. The next level that includes blockchain technology will be ecosystem economies. A realistic scenario envisions companies that start the integration core business functionalities with both third-party networks and platforms. This allows them to be more agile, scale faster and on-demand, and benefit from economies of scale beyond their organizational boundaries though accessing and aggregating otherwise inaccessible resources.

These blockchain ecosystem networks can be either centralized, where a central company runs a blockchain or DLT infrastructure, they can be federated and would typically be run by a consortium, or they can be decentralized. The adoption optimistic argumentation would include the following points: in the long term, there will be a migration from centralized to federated and eventually decentralized networks, participants do not want that a competitor to run the ecosystem. Consortia take a lot of time. Also, possibly, some data-privacy scandals have accelerated adoption. An intensive, detailed, and very differentiated scenario-based analysis of this process can be found in the work of Andranik Tusmanian et al. [19].

[5] https://www.cnbc.com/2017/08/24/technology-killing-off-corporations-average-lifespan-of-company-under-20-years.html.

Sceptics focus on the challenges of adoption, which can be structured into three inherent problem categories. First, the underestimation of the human aspect, second the missing and potentially impossible balance between decentralization and centralization, and third, a set of six business challenges. As was mentioned earlier, this text focuses on the opportunities, which is why these sceptics' arguments are not elaborated at all.

Underestimation of the human aspect

By focusing on removing trust, most blockchain architectures do away with central human elements that turn a reluctant person into a devout user. Possibly this is why the religious aspect of the blockchain community comes back into play and why it is celebrated within the community to various extents. Behavioral economics studies show how people reach and stick to at-first-sight irrational decisions. Numerous experiments prove that we are not fully and strictly rational agents. By trying to communicate, design, and implement a setting that focuses on logic and reason, the adoption threshold rises, since the human aspect, which is relevant and key to human action, is missing.

The blockchain utopia comes with a price and might have negative ethical and political implications. The potential that it brings for emancipation are undermined by the fact that interactions become rigid. If social or transactional relations need to be rigid, like in the context of financial services or property registers, then blockchain technology is an advantage. In the context of human care and education, you may want to have relations that are not rigid. Particularly for social contexts in which there is a necessity for human freedom and responsibility in shaping and reshaping social interactions, the application of blockchain technologies will probably be very undesirable or complicated to design and implement.

If blockchain technology will be used by authorities to enforce a totalitarian and fully transparent society, then the technology will be a Trojan horse and destroy all the libertarian dreams together with the blockchain utopia.

Challenging balance between decentralization and centralization

With the decentralized peer-to-peer approach, Satoshi Nakamoto started a bottom-up movement by introducing a radical innovation. Why did Satoshi Nakamoto decide to stay anonymous? Let us look at some possible answers to have an idea of the challenge of implementing decentralization tools in a large society.

Possibly, Satoshi Nakamoto decided to remain anonymous in order to avoid leadership in a peer-to-peer system. As a de-facto leader and inventor, users would possibly trust the person not the bitcoin data structure and by doing so undermine the idea of trust shift. Moreover, any communication by Satoshi would likely have been interpreted in an investment context independently, whether or not the creator hoped for such an outcome. As a peer, the inventor of bitcoin remained nothing else but a peer. This way, a myth was created, and a great storytelling aspect was born. However, it also shows that a delicate balance even on the macrolevel of the blockchain ecosystem needs to be established to foster adoption.

Another reason for anonymity is the highly regulated aspect of financial markets. By creating a tool like bitcoin, you are a potential threat to very powerful forces in a society. Looking back at the legal debate about the encryption software PGP, labeled as munition in the 1990s, Satoshi Nakamato's decision is understandable.

Business challenges

According a report[6] from one of the Big 5 tax firms, the challenges that need to be overcome before business adoption are related to performance, complexity, regulation, cooperation, and interoperability. Another topic that seems to be relevant is privacy and security concerns, but that needs to be seen in an educational context. Typically, blockchains are not designed to store large amounts of data. There are other peer-to-peer systems that are designed to do that.

Also, since the technology is also about digitalization of value, it can be a driver in the financial industry and is often associated with it. The actions of regulators and policymakers are taking a long time to implement technological development. Consequently, there is an insecurity in the industry and with incumbent organizations. On the other hand, small and agile organizations run risks with an early adoption and might not have a lobby powerful enough to educate decision-makers.

What companies can invest sums large enough to run a team to develop an innovation project, a proof of concept solid enough to be tested and business conditions? It is companies that are very large and have a big-enough research and development budget. If blockchain as a technology is not on a strategic map of top-level management, it typically must go through processes within the organization for the next step of implementation. Blockchain as a tool designed to work in decentralized peer-to-peer environment ends up in the hands of very large organizations that have a hierarchical structure. In this setting, it might be difficult to deploy the originally intended potential.

The important questions for decision-makers in business should be: how does my business look like in a blockchain

[6] https://www.cnbc.com/2018/10/01/five-crucial-challenges-for-blockchain-to-overcome-deloitte.html.

enabled world? What is the price we are willing to pay not to evaluate that question? Only if these questions are addressed can a sustainable business development be guaranteed with arriving new technologies that can have disruptive impact.

Summary

Switzerland is a federated, highly decentralized society with a high stake in the financial market sector. It runs on the forefront when it comes to regulatory efforts and political support of blockchain technology. Both the decentralization aspect and the fact that this third wave of digitalization is about sharing and exchanging value makes it both easy to understand and an opportunity to adopt for Swiss society.

The technology itself offers the possibility to rethink some fundamental decisions that a society must take when it starts digitalizing information, communities, and value. If individuals, organizations, or parts of society want to regain ownership over digital data, blockchain technology can help. However, with regaining ownership over data comes a price. The price is responsibility, which involves some tradeoffs.

In order to be able to make a decision about how to handle the incoming third wave of digitalization it remains of pivotal ethical and political importance to educate users, policymakers, and decision-makers about the potential of the technology. Only when we know the potential of the technology, when we know the potential implications of the use of the technology, and when we know about human aspects handling technology, can we decide on how we want to regulate and apply it. Education is key when a society faces a new technology and decisions on how to handle the technology.

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