As money turns digital and trust turns algorithmic – what ought to be considered?

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Abstract

The aim of the paper is to raise questions and challenges regarding construction of trust in the global online context, using the rapidly growing use of digital currencies as an example of concern. The study raises questions related to cultural values and relations of power, and how that relates to trust, when money is digital and monetary processes are performed by technology. The paper is based on a qualitative study, using semi structured interviews with key personnel related to three different cryptocurrencies. Results indicate that cultural values affect how trust is constructed and perceived. Trust is placed primarily in technology and its algorithms, and is identified as an expression of a technocratic utopian approach, which might be in need of being balanced with accountability concerns. Instead of authoritative institutional processes with assigned roles and responsibilities, decentralized forms with users involvements and users control of their money, are important in establishing trust. Cultural influences from globalization and marketization affects how trust is created. The findings contributes by elucidating a need for further research if blockchain technology is to be used in a domain where requirements of trust, responsibilities and rights, long-term preservation, and long-term accessibility are of high concern.

Keywords: cryptocurrencies, trust, usability, power, information culture

Introduction

What happens when money turns digital and different tasks are run by algorithm instead of people and institutions? What do we ought to consider regarding responsibilities, accountability, trust, and long-term perspective, as well as what societal effect it could have? What questions can we highlight from an archives and information science perspective?

If money takes the form of digital records, questions of archival concern are relevant. Such as how trust is generated and long term usability perspectives. From an archives- and information science viewpoint, records are both an asset as well as documented evidence of transactions and activities (ISO 15489-1:2016). If records possess qualities of authenticity, reliability, integrity, and usability they can be used as evidence, by several actors and across time and space (McKemmish, 2005). Questions around trust are socially constructed for certain purposes, and is often related to power and control (Price & Smith, 2011). Records enable transparency of actions towards each other, and by that an accounting of what we do to each other (McKemmish, 2015, p. 2). Recordkeeping is a foundation for accountability, but is not enough if you cannot act upon it (Hurley, 2005). Why records also have to be connected to regulatory frameworks and a forum in which to proceed a cause. In order for records to maintain their evidential value over time and distance, the aspects of trusted custodians, trusted repositories,

and chain of preservation has been central in archival discussions, which emphasize the responsibility for the maintenance and protection of records and their qualities. The technological development raises challenges related to the maintenance of records qualities, as well as roles and responsibilities as previous tasks are performed in new ways, by different actors, and sometimes by technology. Rigorous research are performed around these questions within for example the InterPARES project (Duranti & Rogers, 2011).

A recurring, hyped, and frequently used concept is cryptocurrencies and Japan has recently announced it as a second national currency, Vladimir Putin, the president of Russia, is considering making investments in the cryptocurrency Ethereum (Bloomberg, 2017)[1], as well as other governments have raised the question of the possibility of introducing digital currencies. At the same time, the motivation and aim with e.g. bitcoin is to create a currency that is not under any authoritative influence; not from any central bank, government, or any other political intervention.

Method & empirical material

The current work is part of ongoing research that intends to raise questions for further research. Three cryptocurrencies are highlighted in the article; Bitcoin, Ethereum, and Saga mono. The method chosen for this study is qualitative, i.e. analyze and describe how something is characterized or structured. A common data collection method within qualitative research methodology is interviews, in this case semi-structured interviews with prepared open questions where the interview is opened with general questions which contributes to a dialog between the interviewer and the interviewee. Same questions have been used in every interview (Jakobsson, 2011).

Data were collected from five interviews: one with the Bitcoin Association of Sweden, a non-profit organization which promotes further use of bitcoin in Sweden, two with brokers at the financial market regarding Ethererum, and two representatives from a financial service specialized in cryptocurrencies which provides the possibility to purchase Saga Mono. The interviews have been complemented with a literature study of published research articles regarding digital cryptocurrencies and also white papers and grey literature. The approach is to initiate a discussion and highlight areas to look further into, as well as raise questions from an archives and information science perspective to consider in the development of cryptocurrencies.

Theoretical lens

As mentioned earlier, trust is socially constructed, and also related to power and control. As traditional processes for generation of trust are challenged, there are questions related to values, culture and power that can be highlighted. The Information Culture Assessment Framework (Oliver & Foscarini, 2014) provide a theoretical lens that will be used to discuss some of these aspects. Three aspects that will be considered in this context are *information preferences, type of political state,* and *trust in recordkeeping systems*. *Information preference* concerns for example in what form and manner information is communicated, what is perceived as authoritative information resource, what is perceived to be trustworthy, and power distance (how authority is exercised and questions of inequality). Type of *political state* concerns the information architecture, and attitudes towards information and information security. The different political states are classified as; Information Federalism, Information Feudalism, Information Monarchy, Information Anarchy and Technocratic Utopia. The Technocratic

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[1] https://www.bloomberg.com/news/articles/2017-06-06/putin-eyes-bitcoin-rival-to-spur-economic-growth-beyond-oil-gas   Article published 2017-06-06, accessed 2017-08-10

Utopia have a technical approach to information management and a high reliance on emerging technologies. A lot of resources are often invested in a "magic bullet" which is expected to solve the problems (Oliver & Foscarini, 2014). The third dimension was regarding *people's trust in recordkeeping systems*, and in this case digital currencies (where the underlying technology works as a recordkeeping system). It's about shared practices and perception of those practices. This concerns the actual functions in the system that enables trustworthiness, and how that is perceived by people. As was highlighted by Oliver & Foscarini (2014), recordkeeping systems will not be used if people don't trust them or lack confidence in them.

Cryptocurrencies

In 2008 the article *Bitcoin: A Peer-to-Peer Electronic Cash System* by Satoshi Nakamoto released the software of Bitcoin as an open source project, a decentralized peer-to-peer cryptocurrency (Nakamoto, 2008). Since then, bitcoin has slowly grown and continues to grow and allows almost instant, near anonymous payments, over the internet with no or low fees. Since it is decentralized, i.e. no control of its operation from an organization or government, it has been described with both several advantages as well as several disadvantages. Because of lack of central entity and monetary policy, the supply of bitcoin has been set in advance and will end at the amount of 21 million bitcoin (Zohar, 2015), which will take place in year 2140 (Meiklejohn el al. 2016). Control by government regulation or intervention may function to guard from and hinder criminal activity although the regulation may constitute costs and barriers on organizations. The purpose of bitcoin can be seen as a way to benefit the digital domain and at the same time through competition and decentralization weaken any third party (Zohar, 2015).

The biggest advantage, described in the literature, is that bitcoin is decentralized but also that it is an open source model which is transparent, stabile, secure, and the access to bitcoins is based on public key cryptography. Another key point that is explained as an advantage is the inability to reverse payments as well as its fixed supply of bitcoins. In contrast to credit cards, bitcoin does not have card numbers or expiration dates (Zohar, 2015). Bitcoin can in one sense be compared with cash since the payer's or the recipient of payments' identities do not need to be visible in order to carry out transactions. And like cash the transactions of bitcoin are irreversible with no charge back, but unlike cash bitcoin requires a third-party mediation (Meiklejohn et al, 2016). Bitcoin is a peer-to-peer network, i.e. a non-hierarchic network with miners that authorizes all money transfers. Moreover, it is based on blockchain-technology, where each block consist of the cryptographic hash and is the identifier of the previous block. It is a competition and so-caller *miners* are rewarded with bitcoins when successfully adding a block to the block chain. Mining has become a fast-growing industry and attracts people to work with the bitcoin network by approving transactions. Although it creates a way of earning money selfish behavior has been detected among miners. Blocks may be strategically released with a delay in order to gain more profit and the protocol of creating blocks that reference the longest chain with an immediately release has been questioned (Zohar, 2015).

Meiklejohn et al, 2016, describes bitcoin as *pseudo-anonymous* where all transactions are transparent and question this anonymity and how it might concern e.g. criminals and money laundering or fraud, trade of illegal goods, because of the problem of identifying users and obtaining transaction records. Meiklejohn et al question the traceability in the transaction flow and suggests "to identify certain *idioms of use* present in concrete Bitcoin network implementations that erode the anonymity of the users who engage in them" (Meiklejohn 2016 p. 87). Meiklejohn et al argue that in order to make bitcoin unattractive for illicit use, an agency with authority would identify and elucidate the flow between different users and to major

institutions. Users of bitcoin may invest in different firms, several such as Bitconica and Bitcoin Savings & Trust has either been shut down because of thefts or being revealed to be a fraudulent investment operation (Meiklejohn, 2016).

Other raised questions with bitcoin than illicit use is that even if the fees are low the storage costs may be high and are not reflected in fees. Also, when moving even a small amount of money via the blockchain will create a record that requires space and cannot be erased. Bitcoin may not just be used to encode monetary transfers but also encode other form of information, e.g. WikiLeaks cables embedded in transactions (Zohar, 2015).

> "Bitcoin's design fundamentally reshapes and reimagines money—one of humanity's most basic and foundational social constructs. Essentially allowing us to transmit value over the Internet just as easily as we transmit information, its disruptive nature promises to change markets, enable new business models, and impact the ability of governments to control money and to regulate businesses".
>
> (Zohar, 2015 p. 133).

The hype and good reputation of blockchain technology has spread to other domains than finance and technology. For example, within medical care, blockchain has been used to manage electronic medical records and to create a decentralized records management system. Azaria et al (2016) demonstrate an innovative blockchain implementation, MedRec, which will e.g. empower patients with access to their own medical history and for researchers, relying in many participating entities, miners to secure and sustain the blockchain log, it will increase interoperability between different hospital systems.

Another domain where the use of blockchain technology has been examined is in recordkeeping and records management. Victoria Louise Lemieux (2016) has in the article *Trusting records: is Blockchain technology the answer* examined blockchain technology as a solution to guarantee preservation of trustworthy digital records. Lemieux examined Factom, an open source blockchain-based solution which creates data layer on top of the bitcoin blockchain, and its proposed implementation for the land registry system of a developing country (Honduras). In the analysis, requirements for preservation of trustworthy digital records and records management and digital preservation standards such as ISO 15489, ISO 14721, and ISO 16363, have been used and gave a mixed result. Two of the major aspects of blockchain technology as well as the solution of Factom is to maintain authenticity and integrity of digital records and according to Lemieux the ability to obtain authenticity is highly dependent on possible system vulnerability. Moreover, Lemieux also highlights that in order to guarantee long-term digital preservation and access, the user need to have a copy of the original data with access to the bitcoin blockchain. Since bitcoin technology does not use financial intermediaries in money transactions or securities trades, with no need of documentation or evidential requirements may be low, bitcoin work well, in a short-term perspective. In the Honduran example where blockchain technology were to be used for the land registry system in order for citizens to prove ownership, i.e. a higher evidential requirement, Lemieux points out key areas for further investigation and argues that this sort of blockchain solution may be least well suited (Lemieux, 2016).

Three examples of crypto currencies
The interview questions that was used in this study aimed to question how qualities like trust and accountability and the conditions for long term preservation, responsibilities, and accessibility is effected when objects and processes become digital. The interviews are divided

into Bitcoin, Ethererum, and Saga Mono and the questions where divided into two categories; trust and usability. The questions in the first category regarded responsibility, accountability and trust and the question in the second category regarded accessibility, preservation and usability.

The result of the interviews is presented below.

Bitcoin

The cryptocurrency bitcoin is based on blockchain technology and is decentralized, which means that it is not controlled or owned by any country or central bank. The idea is that people have control of their money and no third party are involved, which otherwise takes commission for transactions.

Trust

The first category, *Trust,* regarded responsibilities, accountability and trust and the initial questions concerned bitcoin and decentralization.

Since bitcoin is decentralized there is no authority who may help or control if bitcoins will be stolen. According to the interviewee bitcoins may be stolen through e.g. email containing virus that can encrypt the hard drive and then blackmail the owner messaging that the hard drive will be unlocked for a certain amount of bitcoin sent to a certain address. Or bitcoin wallets have been stolen through virus containing keyboard tracker. When bitcoins are stolen there are no one to ask for help.

According to the interviewee this decentralization can be seen as both an advantage but also as a disadvantage. The big disadvantage that the interviewee has enlighten is that bitcoin is money without any security e.g. when you have lost bitcoins you cannot get them back. The advantages with this decentralization is that bitcoin unites people who dislikes the way the banking system is designed. The interviewee argue that the banks earn great profits worldwide and even though there can be currency crises, even crashes, and still the banks will not fall since states repeatedly come to the rescue.

The interviewee argue that one of the most brilliant things about bitcoin is that it can be trusted since it is constructed with a certain type of cryptography that will work for at least thirty to forty years and that the probability of bitcoin being hacked is very small. Being decentralized makes bitcoin, according to the interviewee, trustworthy and one of the reason is that no one has the responsibility for it. There is no CEO for bitcoin and if everyone play by the rules it can be trusted. There are incentives to follow these rules since it is built on rewards. Working as a miner gives you rewards when you create new blocks into the block chain.

Today the market of bitcoin is very attractive and according to the interviewee bitcoin is unique and fulfills various functions and properties of money. According to the interviewee bitcoin is, equal with money, durable since it consists of 1's and 0's and therefore, its life span has no ending. Bitcoin is also portable, unlike heavy gold, it consists of its 1's and 0's and users might send it to other users via smart phones without intermediaries. Another property that the interviewee thought that bitcoin has is that it is fungable i.e. all bitcoins have same value.

Usability

One of the questions that was asked regarded misuse of bitcoin, how it has been misused and how it might be misused in the future. According to the interviewee, who compares this present and growing hype of the use of bitcoin with internet and argue that even though internet has several downsides the overall opinion is positive. He continues by arguing that this will be used in a criminal way e.g. drugs or child pornography and ads that it should not be forbidden just because criminals uses it. Since bitcoin is built on an open source technology anyone, regardless

the purpose, can use it. The interviewee explains that what makes bitcoin so interesting is that anyone can experiment with it but ads that links to child pornography has been detected in the block chain.

When asking who the beneficiaries of bitcoin is today the interviewee answered: "white, young, well-educated men". Most of these were programmers which were attracted by the technical point of view. The interviewee adds that there was a hope that the use of bitcoin would spread to developing countries but it has not yet had that impact.

Ethereum

Ethereum is another cryptocurrency, which is based on block chain technology and smart contracts. According to one of the interviewed brokers, one of the advantages of digital currencies is that it takes away the transaction costs, which is very beneficial especially to big companies. On the ethereum website, it says that

"Ethereum is a decentralized platform that runs smart contracts: applications that run exactly as programmed without any possibility of downtime, censorship, fraud or third party interference (…) it is a shared global infrastructure that can move value around and represent the ownership of property. This enables developers to create markets, store registries of debts or promises, move funds in accordance with instructions given long in the past (…) and many other things that have not been invented yet, all without a middle man or counterparty risk" (Ethereum Foundation)[4].

Trust

What is argued in favor of this currency is that it is funded by some of the biggest banks and corporations in the world, such as JP Morgan, Microsoft, National Bank of Canada, and Master card. The president of Russia, Vladimir Putin has also considered to invest in the currency (Enterprise Ethereum Alliance, 2017)[5]. In the interview it was emphasized as more safe than Bitcoin because it is more transparent, while there are more anonymity around Bitcoin. Users have a so called ethereum wallet, where crypto assets, smart contracts and more can be managed. The platform enable a place for collaboration and creation of digital tokens under conditions of these smart contracts, which can control payments or other forms of agreements. Why no middleman or authority is required and users don't have to trust anyone, since it is controlled by the contracts (Ethereum Foundation, 2017)[7].

Usability

Ethereum uses open source, and the impression is that it provides a platform for people to create projects, enable funding and collaboration with smart contracts taking care of a lot of the administrations. On the website it says that the mission is to provide a platform for research, development and education, where users can produce a next generation of decentralized applications (dapps) "and together build a more globally accessible, more free and more trustworthy internet" (Ethereum Foundation, 2017)[8]. Ethereum is by some market actors promoted as a competitive alternative to Bitcoin, while it says on the ethereum website that they are not competing, rather compatible, and that bitcoin can be used along with ethereum in different ways (Ethereum Foundation, 2017)[9]. There are different 'groupings' around ethereum;

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[4] https://www.ethereum.org Accessed 2017-08-10
[5] https://entethalliance.org/members/ Accessed 2017-08-10
[7] https://www.ethereum.org Accessed 2017-08-10
[8] https://www.ethereum.org/foundation Accessed 2017-08-10
[9] https://www.ethereum.org/ether Accessed 2017-08-10

Ethereum Foundation, Enterprise Ethereum Alliance, as well as the Ethereum Community where different users contribute voluntarily.

Saga Mono

A third cryptocurrency is Saga Mono. It is, as bitcoin, decentralized and is based on block chain technology, where the system regulate itself by algorithms. Saga Mono is not yet introduced to the market, but is in a preliminary phase where they let some people make investments in order to test and correct the system, get feedback from users and raise funds.

Trust

Rules are built into the system, which regulate for example who the coins belong to, and that they are not duplicated or sent to several people. A person with 60-70 years experience of work in a central bank has contributed his knowledge, which has been translated into algorithms in the system. The idea is that control mechanisms in the system will ensure that the transactions are reliable and accurate, and it was expressed that nothing will go wrong. There is a high emphasis on security, for example to protect from hacker attacks. It uses a certain security solution which also banks and governments use, and is perceived to be unhackable and untraceable according to the interviewee. They use 46 digits in combination, while for example visa or master card uses only 16. Both respondents were very confident about that it was a trustworthy system with very low risk, and that every person was controlling their transactions within the e-wallet. The block chain function as a decentralized archive, transactions are recorded and there are information of how much there is in each account. The e-wallet is both on the users computers, as well as on the website. The information is connected to the account id in the users e-wallet, which therefore can be restored if something happens to a users computer. It is anonymous, and the information tells the account id but not who the owner of the account is. New information is added frequently, and nothing is deleted. The e-wallet is anonymous, but some records are required from users that purchase the coins for security reasons.

Usability

Values of national currencies, and their fluctuations are closely related to politics, governments and central banks interventions, which is something that cryptocurrencies want to go beyond. The value of the coin is instead related to supply and demand on the market and connected to technological features that are desired by users. What is unique with Saga Mono is that they have a reserve in hard cash to make sure that there will be no devaluation in case of big transactions. Algorithms will automatically ensure that the price will not drop too much. Traditionally, reserves have instead been used by central banks to ensure the value of the currency. What was emphasized as unique with Saga Mono was their high priority of security and that transactions are very fast, just a few seconds. A user is not dependent on having another party in order to approve a transaction, as it is with Bitcoin. The users can just sell and buy the coins and change them to other currencies as they want whenever they want. The value of the coin will depend on the market, so the value can fluctuate. But what was told in the interviews was that the worst thing that can happen is that it stays on the same price. The coin is promoted as a long term investment, since they believe it will be usable in the future, and probably replace national currencies and credit cards as payment methods. The respondents meant that this coin is more advanced compared to other cryptocurrencies, and very easy to use. There is also a possibility to set rules about how the money can be used,

which can be used for the users own good to have better control of their private economy. One of the respondents meant that each digital currency has their purpose, and comparing them is like comparing apples and pears.

A so called white paper will be released, which reveals quantity (number of coins) as well as part of the code, so it can be checked and verified by users. Theoretically someone could create a digital currency with the information, but they would not have the same technological features, which is what gives it value. It would not be enough to the market. According to one of the interviewees, everyone who have Saga mono will benefit from it, since they expect that the price will increase. At the moment there are higher demand than supply on cryptocurrencies. After 4-6 months after it is released they will also release another feature which will allow everyone who has a smart cashier to use the coin as a payment method. It will be possible to use the coin to pay bills, in major companies, at google for example. More and more companies are accepting digital currencies as a payment method.

Analysis & Discussion

What happens with questions regarding trust and usability when money turns digital? In this article, different questions have been explored related to three different cryptocurrencies. Related to the Information Cultural Frameworks aspects of *information preferences, political state* in regards to information architecture, and *trust in recordkeeping systems* (Oliver & Foscarini, 2014) some aspects can be reflected on. Cultural aspects and what people believe in, influences information preferences and power distance. Instead of national authoritative institutional processes, cryptocurrencies have a global direction, are based on decentralized technical systems, with no third party of authority involved, but instead controlled by algorithms. This also changes conditions for the generation of trust, as well as aspects of usability. It changes relations of power, and raises questions related to inequality: (1) Who benefits, who perceives these currencies as easy-to-use, and who will (not) have access to them?; (2) Who has the ability to assess its trustworthiness?; (3) Who has an influence on how the currencies are developed (and who does not)?; (4) Unclear processes for accountability also raise questions regarding responsibilities.

The value of the coins are connected to supply and demand on the global market and depend on technological features, where a high market value also seem to be an indicator of trust. There seem to be a high level of belief and trust in technology, and it is expressed that algorithms will "take care" of the risks. Just as trust lies with technology, it is also the site for risk, and security is also central in generation of trust. Maybe one could say that this is an example of what Oliver & Foscarini (2014) classifies as technocratic utopia. The risk here is an idealization of technology that don't consider the human factor, that there is always an intention behind the design and use of technology as well as imperfections that have to be balanced with mechanisms and terms for responsibilities. Regarding *trust in recordkeeping systems* (Oliver & Foscarini, 2014), it can be connected to trust in the monetary system as well. There is a systemic critique towards the traditional currency and banking system, and in this case, trust is generated differently. In the three examples, different aspects have been emphasized as the primary reasons for trust. In the case of Bitcoin, the process for validation of exchanges is an example of a collaborative model for creating trust. In the case of Ethereum, big investments from capital-strong actors in the market are used as an argument, as well as that there are many users involved in different ways. In the case of Saga Mono, the expertise involved, and high priority on security and advanced technological features, are emphasized to establish trust. Users are involved at an early stage to establish users perception of trust. In a way, usability is dependent on whether people trust the system or not. It is both a question of actual conditions for trustworthiness, but also to a high degree what people believe in. Ongoing changes in the world

of globalization, marketization and digitalization affects the situation, as well as discussions around who you should trust. As was expressed in the example of Ethereum, it is a system where you do not need to trust other people - instead, technology ensure that processes and transactions are performed reliably. However, we note that *someone* has to design the technology.

What about an archives-and-information-perspective on trust and usability? More research is required related to the technologies in question. Due to changes in how trust is established, there should be more analysis of the conditions for provision of evidence, accountability, responsibility and assurance of consumer rights, usability and preservation and what requirements should be made on the technology in order to ensure a trustworthy system. There might as well be different needs for long-term versus short-term activities. Management of digital money is in a way a management of records. As Lemieux & Limonad (2011) express, records are not only by-products of transactions, they also represent them. As money becomes digital, and also can be replaced by smart contracts or other forms of agreements - how do such agreements effect values and perceptions around records' role in society? Governments, institutions, and different initiatives around the globe examine the possibility of using blockchain technology. And as Lemieux (2016) argues, technology of, e.g. bitcoin, may be suitable when the need of documentation or evidential requirements may be low but when the requirements is long-term preservation and long-term accessibility the technology might need to be further developed. The question is what records professionals can contribute in this development, and if there is a need for further development of records requirements?

> "The Australian initiative, the Honduran proposal and studies in the US State of Vermont and by the Government of Canada underscore how quickly use of this technology may spread and the urgency with which records professionals need to bring themselves up to speed on how to respond to proposals to use Blockchain technology".

(Lemieux, 2016, p. 133)

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