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Motivations and Barriers for End-User Adoption of Bitcoin as Digital Currency

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Abstract

Bitcoin as concept was coined in 2009 and can be described as a partly open and shared transactional database. What makes bitcoin unique is that for the first time, we can prove and move ownership of anything digital without a central authority. The technology facilitates many benefits, one being a worldwide, digital currency and we observe that some stores allow payments in bitcoin. Drawing on concepts from the Diffusion of Innovation theory we investigated: What are the end-users' motivations and barriers for using bitcoin as digital currency? Through a small survey, we collected 135 answers during the summer of 2016. Our findings include that the bitcoin users embrace bitcoin due to technological curiosity, thus an individual reason. The largest group, the non-users, state that they are awaiting for others to start using bitcoin, as they question the value and security issues. We conclude that we may witness a deadlock where “everybody waits for everybody”, and that more research is needed.

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1. Introduction

Bitcoin is defined by Satoshi Nakamoto as: “A purely peer-to-peer version of electronic cash...[that allows]...online payments to be sent directly from one party to another without going through a financial institution” [1]. Nakamoto proposed a peer-to-peer network, with no central authority. On this network, it is possible to prove and change ownership of a digital unit that is called bitcoin. Shortly after, on 03.01.2009, Nakamoto created the first block on the chain, and bitcoin became a reality [2]. In this block, Nakamoto wrote a message that can indicate the motivation for creating bitcoin: “The Times 03/Jan/2009 Chancellor on brink of second bailout for banks”. In the bitcoin community, one common interpretation of this cryptic message is that it can demonstrate criticism to the financial institutions.

In a large number of ways, bitcoin resembles the Internet. Bitcoin can be used for transactions of music files, purchasing, and digital currency, to mention but a few. Similarly, the Internet can be used for communication, e-mail, e-business, surveillance, and more. There are multiple reasons for why the Internet became so widely used (see for example [3]) but at one point in time, the Internet was *bootstrapped*, meaning that is sustained self-growth of attracting new users [4]. For each new user, the value of using the Internet increased for the existing users, which again attracted new users. This makes us wonder if, or when, the same will happen with bitcoin. Bitcoin can be seen as a digital currency. We observe that it is possible to pay for goods using bitcoins, for example on the web shop by the music artist called 50 Cent, see figure 1 below. The bitcoin logo is found on the second from the left.

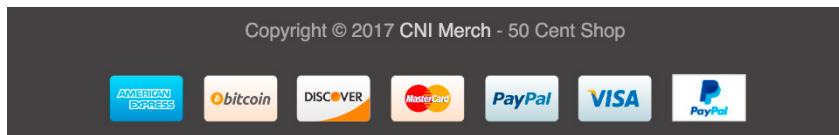


Fig. 1: Screen shot of payment methods on <http://shop.50cent.com/> (accessed July 5th, 2017)

This observation aside, we know little about the individual end-users of bitcoin, and there is a call for research on users versus non-users [5]. The aim of this paper is to provide a small empirical survey from the end-user's perspective and our research question reads: *What are the end-users' motivations and barriers for using bitcoin as digital currency?* The rest of the paper has the following structure: First, we will provide a description of related research on bitcoin, user adoption and network theory. Then we present our method where we describe how we collected and analysed the data. We discuss our findings inspired by the Diffusion of Innovations theory, before we present our insights in the final section.

2. What is Bitcoin?

Bitcoin as concept was coined as ‘a peer-to-peer electronic cash system’ in 2009 with the whitepaper from unknown writer(s) under the pseudonym Satoshi Nakamoto. Bitcoin consists of three main parts: miner, blockchain and wallet. These three parts form the bitcoin network. The miner secures and process the transactions to prevent double spending. “Mining is the act of creating valid bitcoin blocks, which requires demonstrating proof of work, and miners are devices that mine or people who own those devices” (<https://bitcoin.org/en/glossary/mining>). The blockchain is like a bank ledger, and is distributed across the whole network to every wallet on the network, and updated roughly every 10 minutes. The wallet holds a copy of the whole blockchain.

From a technological viewpoint bitcoin is actually a new type of database, allowing “everybody” (meaning every person who partakes in the bitcoin network) to read. It differs from a traditional relational database in the sense that literary no one can update nor delete a transaction. Bitcoin is independent of the Internet, but it needs a communication channel, such as radio waves or blue tooth. Bitcoin is not a currency per se, but a unique unit on the blockchain. The owner of the bitcoin can transfer the ownership of it to another person. Nakamoto addresses the issue of privacy in figure 2. In the traditional transfer model, the bank typically provides the privacy. There is no equivalent for bitcoin, where the privacy is in the protocol.

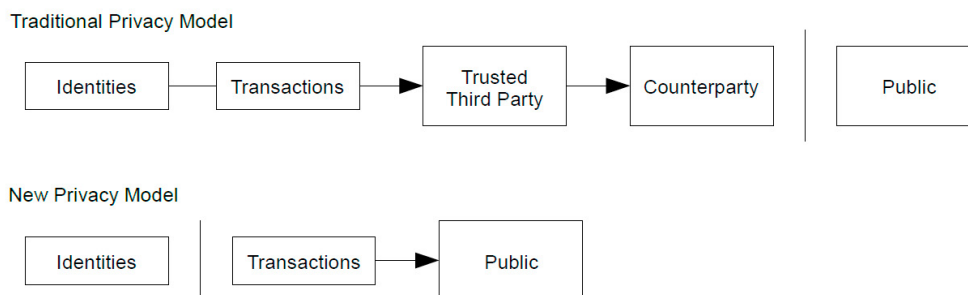


Fig. 2: Traditional and new privacy models [1 p.6]

2.1. Related research on bitcoin and end-user adoption

Apart from research on the technological aspects of bitcoin, such as the validation of transactions as found in [6], researchers are beginning to take an interest in user adoption. We find that many papers focus on current users, such as the characteristics of a bitcoin user. For example, an online survey made in 2013 found that the average user is 32.1 years old. Further, the user is typically male (95.2%), libertarian/anarcho-capitalist (44.3%), non-religious (61.8%), with a full time job (44.7%), and is in a relationship (55.6%) [7]. Bohr and Basir also studied the typical traits of a bitcoin user by means of data collected from online websites. The average age was 33 years, the earliest users started to use it in 2009, almost half of the sample of the users lived in the US, and almost half of the sample identified themselves as Libertarian as political orientation. Bohr and Bashir found three main favourite aspects regarding motivation: anonymity (about 8% of the sample), freedom (about 16% of the sample), and lack of trust in the banking system (about 10% of the sample) [5].

With focus on the non-users and barriers, Tsanidis et al. investigated the consumers' bitcoin awareness, use and levels of trust [8] amongst the Greek. They conclude that the success and future of bitcoin are unclear. Potential users lack information about bitcoin, such as usefulness, ease of use, and possible benefits like saving time and money. Darlington provides a hypothesis that bitcoin provides a distinct advantage to populations living in underdeveloped and struggling economies, since solves the problems of hyperinflation, exchange, counterfeiting, and inaccessibility. The paper also proposes that the three factors that might hinder the adoption of bitcoin in these struggling economies: (i) lack of infrastructure, (ii) potential problems with the bitcoin network itself, and (iii) fear of the unknown [9]. Silinskyte drew upon Venkatesh et al.'s study of the Unified Theory of Acceptance and Use of Technology (UTAUT) model [19] in order to develop hypotheses on individuals' usage behaviour. The hypotheses were tested by carrying out a survey. The results indicated that the factors influencing the usage of bitcoin were performance expectancy, effort expectancy, facilitating conditions and behavioural intention [10].

A research-in-progress was published in March 2016, addressing adoption of bitcoin by companies [11]. They proposed a research model based on Diffusions of Innovation and the Technology Acceptance Model. Ølnes provides a study on how the public sector may benefit from bitcoin, as well as a literature review study. He found that academia started to publish papers on bitcoin in 2011, and we see an increase starting with eight publications in 2011 and up to 208 in 2014. We note that white papers are included in Ølnes' study. Related to this, it is worth mentioning that the initial study by Nakamoto is both a non-peer-reviewed publication and a pseudonym with unknown author(s), but practically every peer-reviewed publication refer to Nakamoto's white paper. Ølnes concludes that few publications have studied bitcoin in the public sector. Several possible benefits are listed, such as storing and securing vital information like contracts and licenses. Ølnes acknowledges that there are many unanswered questions before the public sector can benefit from bitcoin [12].

2.2. Related research on bitcoin and network theories

One obstacle for user adoption may be lock-in or switching cost, meaning the time, money and effort it requires starting using a new technology or innovation [13]. A bitcoin study about *breaking the network effect* identified two

underlying mechanisms: (i) the coordinative efforts of the profit-maximizing entrepreneur and (ii) the ability to use the old and the new currency simultaneously [14].

Bootstrapping as a proverb indicates an impossible task, such as lifting yourself by your own hair. In computer technology, bootstrapping is a metaphor. ‘Bootstrapping the computer’ means to start the machine by means of the computer itself [15]. The name derives from the straps that some boots will have on the top, which helps a person to pull the boot on the foot. It has been used by researchers in information systems in order to investigate the growth of the Internet, see for example [4]. Nobody asked the millions of Internet users to embrace the technology, and for many decades, Internet was also perceived as unnecessary. The explanations for Internet’s current success are multiple, of which one explanation was provided by Lyytinen and Hanseth, who identified bootstrapping. Bootstrapping can be facilitated by (i) Designing initially for usefulness, (ii) Drawing upon existing installed base, and (iii) Expanding installed base by persuasive tactics [4]. The installed base is, simply put, the established users of a product or a technology [13].

Related to bootstrapping is the concept ‘critical mass’. Critical mass as concept originates from nuclear physics, and was described extensively by Rogers in his Diffusion of Innovation theory. Rogers observed how many innovations, despite giving more or less obvious benefits to the people, were rejected by users. Rogers argued that critical mass played an important role in the innovations that did become diffused [16]. Rogers identified four stages of the diffusion process: an innovation, communication through channels, the time aspect and members of a social system. We will return to these stages in the discussion. Rogers also used the S-curve, dating back to Tarde in 1913, consisting of five groups of people: innovators, early adopters, early majority, late majority, and laggards. If a certain number of users – often the innovators or early adopters – embrace an innovation, which is often a technology, they will influence the rest of the users (early and late majority and laggards) and the bootstrapping cycle will be self-reinforcing.

Focusing on the individual level, Hanseth and Aanestad describe how some people might start to use a technology at an early stage, while others want to wait until a large group has started to use it. Based on these individual preferences, Hanseth and Aanestad argue that it is important to identify the people who are willing to embrace a technology at early stage. The problem is that it can be difficult to identify these people [15].

3. Method

We created a small survey with 10 questions. The questions were inspired by existing research as presented in the previous chapter. Our main aim was to obtain qualitative data, but we did also include some background questions such as age and gender, which returned quantitative data. The survey was created in *Survey Monkey* and was sent to three main groups of people: (i) the community Bitcoin Meet-Up in Oslo, (ii) a group of currency trading brokers (Forex brokers) and (iii) finally to a medium size university college in Oslo, of which both students and staff were asked to participate. Our reason for choosing this groups was that we wanted to obtain data from both users and non-users. The Bitcoin Meet-Up assured us answers to users. Since our focus was on bitcoin as digital currency, we included brokers. This sampling technique is known as *non-probabilistic*, and is used when a researcher wants to explore a topic and deliberately chooses instances that are extreme [17]. The survey was active between June and August 2016 and we received 135 answers. The questions were as follows:

1. Do you own, or have you previously owned, a bitcoin?
2. (If yes on question 1): When did you become a bitcoin owner? (month and year)
3. (If yes on question 1): Why did you become a bitcoin owner?
4. (If yes on question 1): How many bitcoins do you own, approximately? (You are 100% anonymous)
5. (If no on question 1): What would it require for you to start using bitcoin?
6. What you think it would require for your family and/or our circle of friends to start using bitcoin?
7. Your age
8. Gender (predefined: female/male)
9. For the students: which faculty do you attend? (predefined categories)
10. If you are working: what is your title?

Since this was an explorative study, we intentionally kept the questions open-ended with a commentary field. (We only predefined questions number 8 and 9 with single-answers buttons.) Our choice of open-ended questions can make the analysis more challenging; people can either be discouraged to making the effort to create text, or we as researchers may misinterpret the answers. To alleviate the qualitative data analysis, we used the technique of identifying themes and performing cross-analysis, as described by [17].

4. Findings from the survey

We structure our findings in the same order of the questions of the survey, before we present the filtered and cross-analysis.

Question 1. Do you own, or have you previously owned, a bitcoin?

Of the 135 participants, 30 answered yes.

Question 2. When did you become a bitcoin owner?

Only 18 out of the 30 participants from the previous question wanted to share an answer. Although the amount of answers are small, we present the numbers in figure 3. Please note that we closed the survey on August 1st 2016, which makes the data collected for 2016 inadequate.

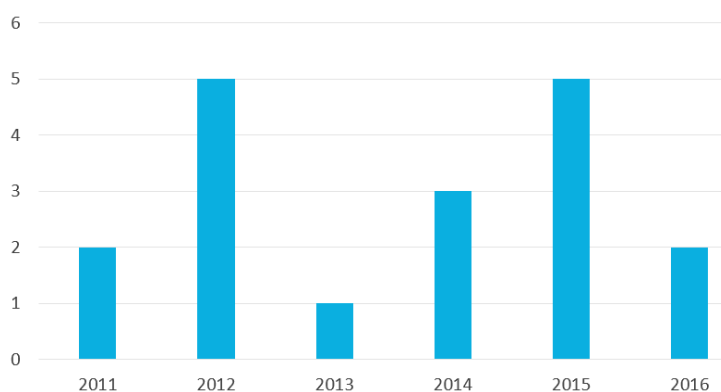


Fig. 3: illustration of what year the participants became bitcoin owners.

Question 3. Why did you become a bitcoin owner?

18 participants chose to answer, and the two main reasons are technological interest and curiosity. In addition, three participants stated monetary gain and investments.

Question 4. How many bitcoins do you own, approximately?

We found a large diversity of the amount of bitcoins that each participant had. Seven of the participants owned one or less bitcoins. Six owned between 2 and 99 bitcoins, two owned respectively 100 and 180, and one participant owned considerably more than the rest: 850.

Question 5. What would it require for you to start using bitcoin?

87 non-users shared their thoughts with us. We clustered the answers and found: stability, security, payment means, used as currency, usefulness, accessibility, greed, wanting a sample, and “*I do not know*”.

Question 6. What you think it would require for your family and/or our circle of friends to start using bitcoin?

The majority of the answers were similar to the previous question, including eleven participants that stated “*No idea*” or “*I do not know*”. (We present more findings from this question in the cross-analysis below.)

Question 7. Your age

98 participants answered. The average age was 38 years. The youngest was 19, the oldest 66 years old.

Question 8. Gender

100 participants answered. 24 were women, 76 were male.

Question 9. For the students: which faculty do you attend?

We got 22 answers. 13 attended the faculty of technology, the rest 5 attended the faculty of communication, management, Film & TV, and Arts.

Question 10. If you are working: what is your title?

We got 81 responses. Since the survey had been sent to certain groups, such as employees of the university college and brokers, the corresponding titles were stated (mainly *lecturer* and (*associate*) *professor*, and *broker*). For the rest, we noted a large diversity, including bartender, senior analyst, systems developer, IT consultant, freelancer, project manager, and finally one instance of “*I do not work*”.

4.1. Filtering to existing bitcoin users only:

Congruent with extant literature, all current users, which amounted to 18, were male. We noted some diversity in age. Amongst the bitcoin users, the youngest were 20, and the oldest were 51. The average age was 32. Of these 18 participants, 5 were students and 13 were working. Unfortunately, not all respondents stated what their title was. From the ones who did share this, we found that 1 was assistant professor, 4 were entrepreneurs, and 4 were IT consultants. As shown above, there was a large diversity in the amount of bitcoins owned, but the motivation was pure curiosity and fascination about the technology. One original quote was “*I wanted to buy drugs online*”.

We find no trace of network effect, or influence by others, when we asked why they became bitcoin users. As mentioned above, reasons are curiosity and technological interest. However, when we studied the suggestions from the users on how to convince non-users, the suggestions were multiple, and here we note traits of the network effect:

“*It must be explained in a simpler manner, and of course: others must use it.*”

“*It cannot be called bitcoins. ‘Money’ is the only term people will understand.*”

“*Must be mainstream. Clear laws and regulations. Integrated in Point-of-sale. Easy to purchase and store in a regular online bank.*”

“*More positive publicity. Media must write positive articles.*”

4.2. Filtering to the non-users only:

This group had clear requirements for them to start using bitcoin: *stability, security, must see value, usefulness, and ease of use*. Both male and female non-users stated the same opinions. One quote revealed some interest: “*Vipps with bitcoin = interesting*”. (Vipps is an application that allows payment with your mobile phone. Authors’ comment.) This quote could have multiple meanings. Either, the participant wants bitcoin integrated with Vipps, or, she wants to trade bitcoins as she now transfers money with Vipps. Regardless, transferring bitcoin with your mobile phones is already possible. The main difference is that Vipps is connected directly to your bank. Bitcoin is not – it is connected to all participants of the bitcoin network, which builds up the block chain and stores the bitcoin.

The similarities, are however, found in the network effect. The more people using bitcoin, the more value it generates to both existing and new, potential users. We also note some aspects from network theory: one respondent admitted that he *would be the last one to use it* – a laggard in the S-curve as presented in Rogers (2003).

When we asked what it would take for their friends or family, the answers were: “*no idea*”; “*haven’t got a clue*”, and similar. We got the impression that they were not interested. Rather, they turned the question back to us: “*why should anybody use this*”?

Summing up our findings, we observe that issues of payment and currency are dominating. This may be due to our introduction of the survey where we described bitcoin as a “digital currency”. It may also imply that the majority of our participant has a limited comprehension of the concept of bitcoin, since our participants frequently stated “*No idea*” or “*I do not know*”.

5. Discussion of the findings

In this section, we discuss the results while building on Rogers' four main stages, prior to reaching critical mass. The four stages are innovation, communication through channels, time aspect, and members of a social system. First, Rogers claim that we need **an innovation**. Perhaps for the first time, we have the possibility to move and prove the ownership of digital currency without a third party, by means of the Blockchain. Second, the innovation must be **communicated through channels**: bitcoin is communicated through Meet-ups, TV commercials, Google Search (or similar channels facilitated by the Internet), and through peer-reviewed research. Given our results, bitcoin could probably be communicated more extensively. The third stage is the **time aspect and S-curve**: we think that current bitcoin users match the "Innovators" category in the S-curve. This means that focus should be placed on reaching critical mass, and identifying the change agent, communication network and opinion leadership. Forth and last, this must happen **among the members of a social system**: "everyone" can use bitcoin, both organisations and individuals. We now briefly discuss our findings based on Rogers' advice in order to reach critical mass:

First stage: Highly respected individuals should use bitcoin. These individuals can serve as pillars for the new service, so that others can follow their example and start using the innovation. A new question arise: in this case, should this actually be individuals, or rather an organisation such as a bank or a store? The comments from the non-users and users both point to having stores where they can spend the bitcoin, as well as having a secure place to store them, typically a bank. We believe that most people will not trust the bitcoin protocol alone and it would facilitate adoption to have a third party, although this was initially the whole idea behind bitcoin, as described in [1]. This aspect aside, it could be a business opportunity for banks, PayPal, or alike, but this discussion is beyond the scope of this study.

Second stage: If possible, change the perception of the innovation, for example by implicating that the critical mass has already been reached. Based on our findings, implicating that critical mass has been reached is not an option at this time. Rather, we think that we may have to rename the concept of bitcoin and some of the appurtenant elements. Our participants stated that both ease of use and a common understanding is currently lacking.

Third stage: Bitcoin as service should first be introduced to groups that is most perceptive to innovations. Our survey identified some traits of the users, and our results concurs with extant research. It indicates that the perceptive people are found in technological communities, with a job, age mid-thirties, and often male. The problem is that this group perceives themselves somewhat detached from the non-users.

Fourth stage: Incentives for using the innovation should be provided. The non-users did not see any value in using bitcoin, or, they stated concern about privacy and safety. We think these concerns are valid; we are, after all, talking about people's monetary assets.

Nakamoto claims that theft of bitcoins will backfire on the hacker: *"If a greedy attacker is able to assemble more CPU power than all the honest nodes, he would have to choose between using it to defraud people by stealing back his payments, or using it to generate new coins. He ought to find it more profitable to play by the rules, such rules that favour him with more new coins than everyone else combined, than to undermine the system and the validity of his own wealth"* (p.4). We think that more discussion is needed on the last argument. People tend to fall in the trap of *Tragedy of the commons* [18], which, in this context, we regard as network effect gone amok: "Everybody else exceeds their fishing quota, therefore I will also fish as much as I like". Eventually, there are no fish left in the ocean, and the value of everybody's wealth are lost. Another threat to bitcoin is censorship: a whole state, like China, Russia, Europe, or USA, could master the resources to censor the innovation. However, we argue that this is a complex issue that needs considerably more research.

Zooming out from Roger's tangible guidelines, we identified the following dilemma: the non-users wait for other non-users to start using the technology. This is the classic chicken-and-egg dilemma. The bitcoin users are not too optimistic. The quotes typically stated: *"it will never happen that my friends or family will use it"*, others were humoristic: *"the only way that my friends and family will start using bitcoin will be for me to exchange my friends and family"*. Addressing our findings about the chicken-and-egg dilemma and the users' concern, we conclude that we need more research on this.

6. Limitations of the study and suggested further research

Our survey had few questions and was sent to predefined groups. Our focus was on bitcoin as digital currency and we introduced the survey by explaining bitcoin as “a new, decentralised currency that is not owned by anyone”. We acknowledge that this influenced our participants, especially the non-users, to think of this technology as a digital currency only. We did not obtain enough answers to make any statistical significance; however, this was not our aim. Rather, our aim was more explorative and descriptive in nature. As future research, we recommend more in-depth interviews, especially with non-users. Our study indicated that non-users do not see the value of using bitcoin, and one future study could demonstrate both pros and cons so that the individual can make an informed decision. We also suggest starting a longitudinal study of the evolution of bitcoin. Researchers now have the unique opportunity to study an innovation at an early stage, and several aspects from network theories are subject for investigation, such as *installed base*, *bootstrapping* and *adaptation* from the Information Infrastructure theory [4] or *critical mass* from the Diffusion of Innovations theory [16].

7. Conclusion

This explorative paper has studied users and non-users of bitcoin. Building on the Diffusion of Innovation theory, we provide some insights about the two groups of people. As expected, we found that existing users are motivated by technological curiosity, and not by monetary incentives or external influences. The users perceive themselves as a group that is somewhat detached from the non-users. The non-users are demonstrating little interest. They question the benefits and security, and are awaiting for other non-users to start to use bitcoin. While we do not think that we will receive our pay checks in bitcoin any time soon, we argue that bitcoin as an innovation should be subject to several studies in the near future.

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