Individuals' Cryptocurrency Adoption: A Proposed Moderated-Mediation Model

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Abstract

Although adoption of cryptocurrencies has received much attention in recent literature, little is known about what factors affecting adoption of Bitcoin. Since the context of cryptocurrencies is different from traditional technologies, several factors derived from the Blockchain technology may play important roles in adoption. We conducted email interviews with 165 students to identify the positive utilities (benefits) and negative utilities (risks) attached to Bitcoin. Then, based on a literature review and the results of our explorative research, we propose a qualitative theoretical model which extends the Unified Theory of Acceptance and Use of Technology (UTAUT) and utility theory. Our theoretical model consists of correlations amongst the following constructs: positive and negative utilities, structural provisions, perceived value, attitude, personality traits, and intention to adopt Bitcoin. The proposed model can serve as a foundation for future studies addressing factors shaping individuals' Bitcoin adoption decisions. Further research is required to empirically test the model to articulate Bitcoin adoption at the individual level.

Keywords

Blockchain, Cryptocurrency, Bitcoin, Theoretical model, Interviews

Introduction

Cryptocurrency is one of the most popular applications of Blockchain. Several types of cryptocurrency are now available in the market. Bitcoin, however, as one of the first cryptocurrencies, is still considered as a pioneer since most other cryptocurrencies are based on Bitcoin's protocols (Narayanan and Clark 2017). Bitcoin is a peer-to-peer digital currency with no central authority such as an administrator, or a firm controlling it. Bitcoin is recognized as a decentralized digital currency by the U.S. Treasury (Calvery 2013). A decentralized network of globally distributed nodes is used to validate and confirm transactions in order to reduce the need of having a central intermediary. This network is also referred to as peer-to-peer (P2P). The P2P decentralized network prevents a single point of failure and a security breach (Fromknecht et al. 2014). Currently (as of April 2019), Bitcoin has the highest market capitalization amongst numerous cryptocurrencies being traded on global exchanges (CoinMarketCap 2019). Customers often use Bitcoin to purchase a great range of products and services online (Draupnir 2016).

Although there are several attempts amongst Information Systems (IS) scholars to identify the barriers to Bitcoin adoption from customers' point of views, significant theoretical contributions are still scarce. Economists, computer scientists, finance scholars and IS scholars study Bitcoin and its adoption from many different lenses. According to the existing Bitcoin literature, the majority of studies can be divided into five main categories. One group of studies has focused on the potential use of Bitcoin for illegal activities and has not examined the motives of general users to adopt it for legitimate uses such as for e-commerce or for money transfer (Saito 2015). The second group of studies has investigated Bitcoin for its technical properties such as design science, cryptography, proof of work algorithm, or exchange rates perspectives (Li and Wang 2017). The third category of research has called readers' attention to analyze the differences between the technical, usability, and social characteristics of different cryptocurrencies (Notheisen et al. 2017). The fourth category of studies has attempted to distinguish adopters from non-adopters based on either drivers or risks associated with Bitcoin (Connolly and Kick 2015). The last category has attempted to use widely accepted adoption models such as TAM and UTAUT to predict adoption behaviors. Thus, they mainly focused on the perceived usefulness and perceived ease of use in the context of Bitcoin adoption (Abramova and Böhme 2016).

We argue that the existing widely-used IT adoption models may not be able to completely explain the perceived benefits, barriers, and specific factors associated with the novel concept of cryptocurrencies (such as Bitcoin). Cryptocurrencies are a completely different class of assets, with financial and social properties that do not overlap or correlate with any other class of assets created in the history of human civilization (Corbet et al. 2018). The innovative characteristics of Blockchain technology call for an extended version of adoption model with greater explanatory power. We believe that new variables should be added to the established adoption models to better address the dilemma of individuals' Bitcoin adoption. Thus, in this study we propose a new conceptual model based on UTAUT and utility theory to better articulate perceived benefits, perceived risks, facilitating conditions, and social effects in the Bitcoin context.

Methodology

In order to understand Bitcoin's benefits and challenges, using the Qualtrics cloud-based survey tool, we conducted email interviews with 165 randomly chosen students enrolled in the evening MBA and BBA in MIS majors at a large university in the southern United States. These students were working professionals with different professional backgrounds. To examine the adoption, we only focused on nonusers of Bitcoin who were generally familiar with the underpinning technology of Blackchain. In order to ensure that respondents were aware of how Bitcoin works, prior to the interview questions, they were asked to watch six informative videos about Bitcoin. The videos simply explained what Bitcoin is, how it works, and what Bitcoin mining and Bitcoin wallet are. The interview questions were open-ended and encouraged participants to write about the key benefits and harms of adopting Bitcoin. At the end of the interview, we asked participants to categorize Bitcoin features into "Benefits" and "Risks" groups. Then, we applied coding schema to better categorize open codes (any values or harms) into axial codes (categories). Several low-level codes (106 codes) were developed and the coding schema was defined. Two coders then independently developed agreement metrics for these codes. According to McHugh (2012), the Inter-Rater-Reliability (IRR) metric is acceptable if it is lesser than 75% and Cohen's Kappa metric should be lesser than 0.75. This step was repeated till the agreement metrics fell within the acceptable range. After agreeing the coders (i.e. IRR > 90% and Cohens Kappa > 0.75), the first phase of coding was considered complete. For example, vulnerability, price fluctuation, price variations, variability, and unpredictability of value were all combined under the instability open code. Next, the identified open codes were combined to form higher level codes using a coding paradigm in which the authors linked related open-codes to form a higher level axial code. The coding paradigm clearly defined interactions amongst the open codes. Further, authors shared the definitions for each open code and the axial codes with four Ph.D. students in IS, who validated the content by categorizing the open codes into axial codes. The authors then calculated the IRR. If the IRR was less than 75%, the authors proceeded to distill and combine a few more open codes with existing ones until an agreeable IRR metric of greater than 75% was attained. Often to reconcile differences, the authors conducted a brief meeting with the coders. For instance, instability , lack of regulation, risk of scams, irreversibility, difficulty of traceability, lack of physicality, and perceived technical flaws (as seven open codes) were categorized into a higher level code named negative utilities (axial code).

The results of categorization indicate that respondents' perceived benefits consist of six dimensions: fast transaction, investment, ease of use, pseudonymity, low transaction cost, and universality. Moreover, based on the findings, respondents' perceived risks consist of seven dimensions: instability, lack of regulation, risk of scams, irreversibility, difficulty of traceability, lack of physicality, and perceived technical flaws. In this model, we included both positive utilities and negative utilities associated with Bitcoin because according to Cenfetelli and Schwarz (2011), the barriers to predict technology adoption are not necessary the opposites of the enables. The rationale behind the inclusion of facilitating conditions and social effects is because even if individuals are aware of possible benefits and risks, they may not necessarily adopt Bitcoin in the present form (Sadhya and Sadhya 2018).

Beside potential benefits and risks, respondents highlighted other factors which may shape their adoption decisions. The first one is considered as social effects with four dimensions: perceived publicity, social image, network effect, and social norms. Social effects cover the possible considerations from society, groups, or significant others that may encourage/discourage individuals to switch to Bitcoin for conducting financial transactions. The second factor is structural provision which consist of two dimensions: perceived vendor support and perceived facilitating infrastructure. The structural factor reflects the possible requirements that should be available in order to facilitate the use of Bitcoin among people. The last factor is personality traits with two dimensions: self-efficacy and innovativeness. This factor implies the importance of individual characteristics in adopting Bitcoin. The remaining variables in the model (i.e., perceived value from Bitcoin, attitude toward Bitcoin, and behavioral intention to adopt Bitcoin) are mainly borrowed from studies used utility model and UTAUT. Figure 1 shows the moderated mediation conceptual framework proposed by this study to explain Bitcoin adoption at the individual level.

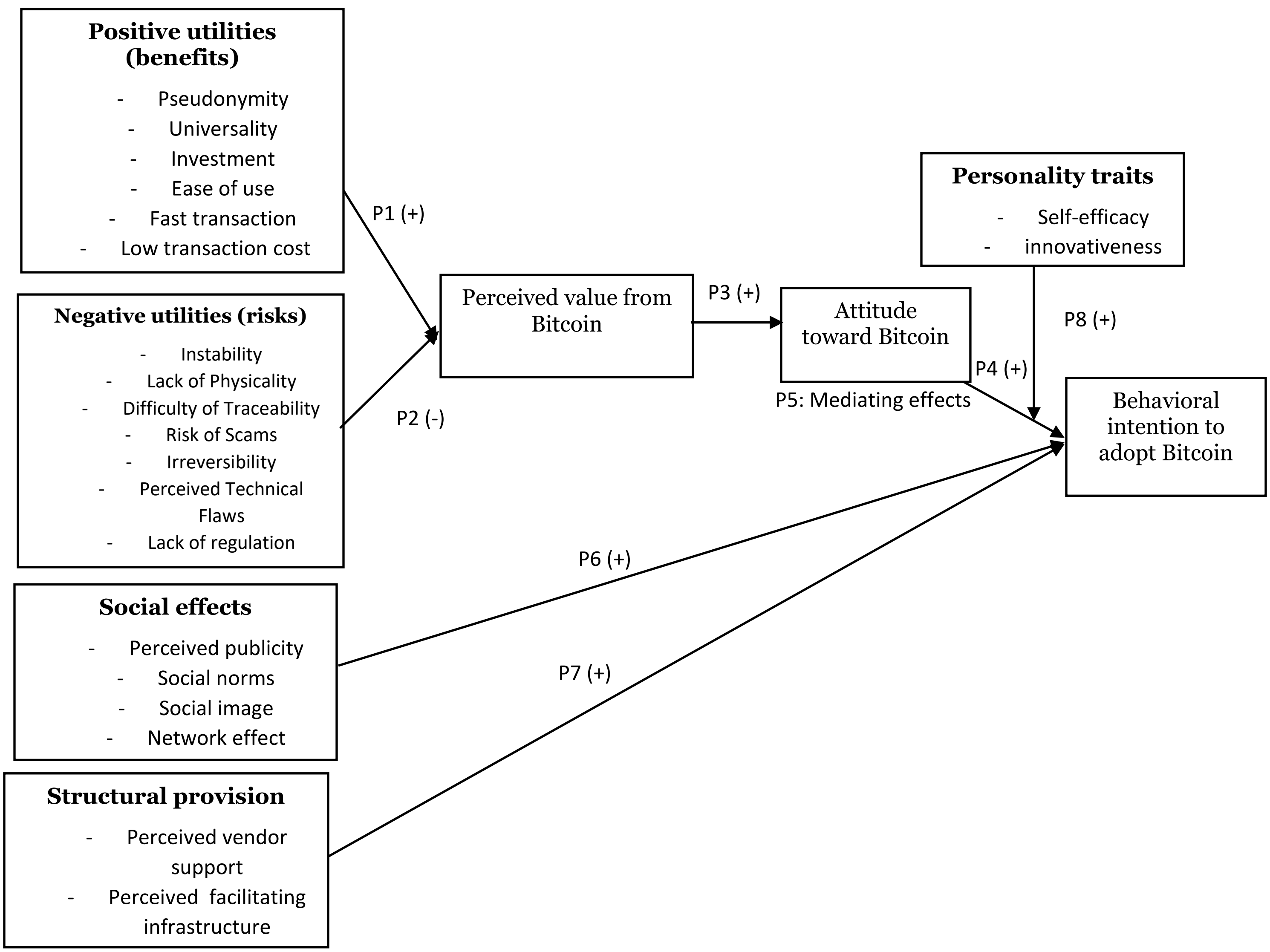

Figure 1. Proposed Theoretical Framework

Proposed constructs, dimensions, and hypotheses development

Positive utilities

In this section, we describe the key benefits of using Bitcoin in financial transactions from the potential customers' perspectives. We propose that positive utilities associated with Bitcoin has six dimensions as follows:

Pseudonymity

The first dimension relates to the ability of individuals to hide their personal identity while transacting with other users. Individuals do not necessarily need to reveal their real names and identifying information while doing a transaction (Reid and Harrigan 2013). However, most Crypto-to-Fiat exchanges globally mandate that cryptocurrency to fiat conversions will only happen if the user provided identifying information through KYC/AML disclosures. The pseudonymity of Bitcoin can increase its utility since true users' identities on the network and public ledger will not be released. However, the need to disclose identities at touch-points such as fiat exchanges makes the use of this feature subject to debate.

Universality

The second dimension refers to the specific characteristic of digital currencies that make them usable globally (Peck 2017). This is because there is no central authority controlling or administering the network. Thus, worldwide availability and accessibility of Bitcoin at any location provides a universal payment service that may reinforce the positive utilities associated with Bitcoin. However, existing global regulations about cryptocurrencies such as bans of conversions to fiat currency currently in force in India, and, a ban on crypto-exchanges in China may have a very significant impact on adoption as a financial instrument (Sapovadia 2015).

Investment

The third dimension indicates the opportunity of using Bitcoin as a promising investment option. Individuals may purchase and hold Bitcoin in the hopes of selling it at a higher price for a profit (Hayes 2017). Bitcoin can be considered as a profitable asset for individuals as it may have greater value in the future. Thus, creating wealth can be a utility enhancer to affect an individual's Bitcoin adoption decision. This dimension meaningfully differentiates Bitcoin context from most of previous technologies since Bitcoin is considered as a store of value and its utility is not necessarily limited to its usage.

Ease of Use

The ease of use dimension reflects one of the most important variables embedded in the established IT adoption models (Venkatesh et al. 2003). By relying on a decentralized network of nodes and consensus algorithm, Bitcoin provides a simple and easy to use financial service platform. The features of Blockchain technology reduce the complexity of using Bitcoin and decrease the degree of users' energy needed to use it. This dimension should not be confused with the complexity of creating, encrypting, and validating processes conducted by miners. This dimension implies the easiness of using Bitcoin to transfer money or to purchase a product/service from individual users' perspectives.

Fast Transaction

This dimension emphasizes the extent to which Bitcoin transactions are originally intended to be quick. A Bitcoin payment is expected to take a little time before consummation. It is assumed that it is not time consuming to make a financial transaction using the decentralized network of Bitcoin and it can save users' time in performing financial transactions. The average time spent on a Bitcoin transaction can be very short depending on the current hash rate combined with transaction size of the Bitcoin network (Bonneau et al. 2015). Fast transaction can be seen by users as a utility enhancer.

Low Transaction Cost

The last dimension describes the transaction fees that customers have to pay for the use of Bitcoin in financial transactions. The average Bitcoin transaction cost is reasonable compared to other traditional or online payment methods (Möser and Böhme 2015). Using Bitcoin can save the transaction handling fees in performing financial transactions. Low transaction fees can also reinforce the positive utilities of using Bitcoin. Therefore, the mentioned dimensions of positive utilities lead to the following proposition:

P1. Positive utilities (benefits) positively influence perceived value from Bitcoin

Negative utilities

In this section, we describe the key risks of using Bitcoin in financial transactions from the potential customers' perspectives. We propose that negative utilities associated with Bitcoin has seven dimensions as follows:

Instability

Literature shows that a huge source of risk for many potential users has roots in the Bitcoin's volatility of exchange rates (Polasik et al. 2015). Users may believe that they may lose their money or investment in Bitcoin because of its price fluctuation. This could raise concerns about the Bitcoin price and value that may unpredictably decreases over a short period. Thus, for many individuals, Bitcoin as a cryptocurrency is still in its nascent stage. Accordingly, the instability of Bitcoin value can be recognized as an influential utility reducer.

Lack of Physicality

Bitcoin (as a cryptocurrency) is a digital or virtual currency designed to work as a medium of exchange. Thus, users cannot physically see or hold Bitcoin (DeMartino 2016). This characteristic may make individuals feel uncomfortable because Bitcoin is mainly stored in digital forms. Performing financial exchange using Bitcoin may be risky because it does not exist as a physical currency (conventional money). Bitcoin's lack of physical form is something that may scare uses and, in turn, reduce utility. It should be mentioned that paper Bitcoin wallets are now available but the majority of respondents seemed to consider Bitcoin as an intangible currency.

Difficulty of Traceability

Tracking Bitcoin transactions for taxation or legal purposes is complicated for users. Tracing ownership of particular Bitcoin units across serial transactions could cause some challenges for customers (Vasek et al. 2014). The peer-to-peer network of Blockchain technology makes the Bitcoin system risky because it is not easy to trace digital transactions. The degree of complexity associated with traceability of Bitcoin can increase the risks attached to Bitcoin transactions.

Risk of Scams

Another source of threat is concerns about the risk of fraud associated with Bitcoin (Khan 2015). For instance, the potential fake Bitcoin wallets hiding malware can be threatening to Bitcoin users. Individuals may be afraid of Bitcoin phishing impersonators or worried about Bitcoin scams which offer to instantly exchange Bitcoins for money. The threat of scammers and vulnerability of a wallet (e.g., a wallet can be accessed if the users inadvertently give away their private key) can significantly give rise to negative utilities.

Irreversibility

Bitcoin transactions are originally intended to be immutable and unchangeable. All transactions are timestamped and recorder in a public ledger and users are not able to change, reverse, and return the money exchanged (Ateniese et al. 2017). This may concern customers that they cannot undo transactions once performed. Customers may be afraid that they will lose money due to careless mistakes (such as wrong input of the amount of money). Therefore, the perceptions that Bitcoin transactions can neither be changed nor removed can decrease utilities associated with using Bitcoin

Perceived Technical Flaws

Technological underpinning and hash functions may not be well-known to the majority of people. Lack of awareness about how a decentralized network works, raises concerns about technical flaws of Bitcoin transactions. Mining techniques and how Bitcoin is generated is still a mystery for the public. Customers will possibly become concerned that Bitcoin payment service may not perform well, thus, this may create problems with the payment process. People perceptions about the probability that something will go wrong with the technical performance of Bitcoin is high (Post et al. 2018). Therefore, perceived technical shortcoming can play an important rule to attenuate utility of adopting Bitcoin.

Lack of Regulation

Bitcoin is operated based on the decentralized management protocols with no central intermediary. Thus, Bitcoin transactions are not supported by the government and are not backed by banks or financial institutions (Grinberg 2012). Moreover, opposition by regulators and legal ambiguity around Bitcoin ecosystem can worry potential adopters about some unknown vulnerability and loss of Bitcoin in particular. Lack of regulation can also be recognized as a utility reducer. Accordingly, relying on the mentioned dimensions of negative utilities, we formally state the following proposition:

P2. Negative utilities (risks) negatively affect perceived value from Bitcoin

Perceived value and attitude toward Bitcoin

According to the utility theory, perceived value is conceptualized as customers' assessment of the ratio of perceived gains to perceived sacrifices associated with the products or services (Payne and Holt 2001). Perceived value is a trade-off between favorable elements (positive utilities) and sacrificed attributes (negative utilities). In this study, respondents believed that compared to the likely concerns and risks, potential benefits of Bitcoin are greater and the use of Bitcoin delivers individuals a greater value. Previous IS studies indicate that perceived value reflects utility by comparing benefits and costs and, in turn, predicts consumers' intentions to adopt a technology through shaping their attitudes toward the technology (Kim et al. 2007; Yang et al. 2016). Moreover, consistent with TRA, favorable attitude toward Bitcoin will increase individuals' intention to adopt it (Fishbein and Ajzen 1975). This leads to the following propositions:

P3. Perceived value from Bitcoin positively affects individuals' attitude toward it
P4. Attitude toward Bitcoin positively affects behavioral intention to adopt Bitcoin
P5. Attitude toward Bitcoin mediates the relationship between perceived value from Bitcoin and individuals' intention to adopt Bitcoin

Social effects

Consistent with the results, we propose that social effects consist of four key dimensions as follows:

Perceived Publicity (Image)

This dimension of social effects refers to the overall public image and reputation of Bitcoin in society. Public publicity is about how the Blockchain technology is discussed in social media and whether stories about Bitcoin has received good publicity in the news. Factors such as lack of trust in the reliability of the Bitcoin system or use of Bitcoin for illegal activities (e.g., money laundering) can make individuals concerned about the public image of Bitcoin (Angel and McCabe 2015). Publicity due to online word of mouth and articles in the press can fundamentally change the public intention to adopt Bitcoin.

Social Norms

Currently, there are a wide range of payment methods and customers have unlimited choices to use for financial transactions. In line with UTAUT, social norms play an important role in shaping individuals' adoption decisions (Venkatesh et al. 2003). For instance, the influence of significant others (people whose opinions are valuable to users) or suggestions from accomplished persons will meaningfully affect Bitcoin adoption decisions.

Social Image

Individuals are likely to use technologies that support their desired social-image (Venkatesh and Bala 2008). For instance, people who want to standout from the crowd, appear cool and comfortable with the latest technologies may have a higher tendency to adopt Bitcoin. Users may believe that people of their community who use Bitcoin have a more prestigious reputation and have superior profiles than those who are not attached to it. This status symbol in the community can entice customers to adopt Bitcoin.

Network Effect

This dimension of social effects refers to the beliefs that if many people use Bitcoin for their financial transactions, the individual utility for each user increases exponentially. The network effect also describes the beliefs that the number of Bitcoin users is on the rise. According to extant literature, Bitcoin adoption is dependent on the number of people who have already used Bitcoin for payment purposes as well as number of users who will join the Bitcoin network (Nair and Cachanosky 2017). The denser and larger the decentralized Bitcoin network, the more likely users are to adopt and use Bitcoin. Formally stated:

P6. Social effects positively influence individuals' intention to adopt Bitcoin

Structural provision

We propose that beside the perceived benefits and risks linked with Bitcoin's features and the social effects resulting from the influence of society and community, structural provision plays an important role in the context of Bitcoin adoption. Structural provision refers to all the requirements and infrastructures available to streamline and support the process of adoption. This construct has two dimensions as follows:

Perceived Vendor Support

One of the most pressing concerns of individuals is low adoption of Bitcoin by merchants (e.g., shops, online retailers) (Ly 2013). Perceived vendor support relates to the perception that whether a majority of businesses would accept Bitcoin as a method of payment. If adequate outlets, companies, and online retailers support Bitcoin payment services, individuals become more likely to adopt Bitcoin as an alternative. Thus, adoption of Bitcoin by businesses as well as the number of merchants accepting Bitcoin directly influence the individuals' adoption decisions.

Perceived Facilitating Infrastructure

In line with UTAUT, individual adoption decisions are affected by facilitating conditions (Venkatesh et al. 2003). In the Bitcoin context, perceived facilitating infrastructure is defined as the degree to which an individual believes that the required technical infrastructure is available to support use of Bitcoin. For instance, it is important that enough distributed apps for buying/selling Bitcoin exist and adequate infrastructure to cash out Bitcoin is available. It is also essential that enough Bitcoin ATMs are available to help users with money exchange purposes. Finally, Bitcoin consulting services can play an important role in addressing Bitcoin adoption issues by providing information about Bitcoin ecosystem and by helping individuals to participate in the cryptocurrency market. Therefore, we propose the following:

P7. Structural provision positively affects individuals' intention to adopt Bitcoin

Personality traits

Although perceived value, which is a cognitive trade-off between overall costs and benefits associated with Bitcoin, directly encourages individuals to adopt Bitcoin, we propose that personality traits would also be able to influence this equation. In this study, we consider two dimensions for personality traits as follows:

Self-efficacy

Consistent with Compeau et al. (1999), in the Bitcoin context, self-efficacy is defined as the degree to which individuals are confident of using Bitcoin even if there is no one around to show them how to use it. Individuals with high self-efficacy are assertive enough to use Bitcoin even if they have never used it before. Users who demonstrate high self-efficacy are individuals who use Bitcoin in financial transactions if they only have the online instructions. Thus, we propose that the attitude-intention relationship is intensified when individuals exhibit higher levels of self-efficacy.

Innovativeness

Personal innovativeness indicates whether individuals who heard about a new technology, would look for ways to experiment with it (Agarwal and Prasad 1998). Innovators are well-informed about recent technological advances and take risks in their adoption decisions. Innovative users are usually the first to try out new IT among their peers. Individuals who exhibit high levels of innovativeness, in general, have more tendency to embrace new changes. Therefore, we propose that the strength of the linkage between attitude toward Bitcoin and adoption intention, will be improved depending upon whether individuals exhibit greater personal innovativeness. These arguments help us develop the last proposition as follows:

P8. Personality traits positively moderate the relationships between attitude toward Bitcoin and intention to adopt Bitcoin

Discussion

There are many stakeholders, in the Bitcoin ecosystem, that profit from a higher adoption. Stakeholders such as application developers, cryptocurrency entrepreneurs, miners, and investors have taken the initiative to promote use of cryptocurrency (Kazan et al. 2015). Consistent with Mattke et al. (2018), the success of Bitcoin as a means of payment depends on a high number of people using Bitcoin. However, Bitcoin has not seen widespread adoption among individuals as a favored mode of payment (Polasik et al. 2015). Researchers have neglected to investigate socio-technical factors such as situational constructs, functional challenges, benefits, individual characteristics, and societal outcomes (Porru et al. 2017). Thus, it is important to take a deeper look at Bitcoin adoption. We argue that the existing IT adoption models (such as UTAUT) may not be the right theoretical lens to identify positive and negative utilities of Bitcoin. Bitcoin (as a cryptocurrency) is different from consumer technologies and does not exhibit the same technological attributes and characteristics possessed by traditional technologies. Thus, this research gap justifies an extension of the existing IT adoption models. We developed seven propositions based on the results of our email interviews with 165 students in the United States. This explorative study proposes an extended model that contributes to literature and has implications for practice. This work can contribute to our current understandings of bitcoin adoption by developing a conceptual model which highlights antecedents of Bitcoin adoption. We propose that individuals' adoption decisions can be shaped by positive utilities (benefits), negative utilities (risks), structural provisions, perceived value, attitude, and personality traits. Thus, Bitcoin stakeholders may need to put their efforts into means of increasing benefits, reducing risks, addressing social concerns, and reinforcing situational factors to serve and retain a wide range of users.

Conclusion

Bitcoin adoption has increasingly gained attention from both academics and practitioners. However, Bitcoin is still in its early stages and a widespread adoption of Bitcoin needs further efforts from the proponents of this technology. Previous studies have neglected to integrate both technical and non-technical factors associated with Bitcoin. This study has attempted to fill this gap in the existing literature. Based on an extensive literature review (using Blockchain, Cryptocurrency, and Bitcoin as the main keywords) and an explorative study, we identify factors that may play an important role in the Bitcoin adoption equation and categorize them into four main antecedents: positive utilities (benefits), negative utilities (risks), social effects, and structural provision. This study proposes a theoretical moderated mediation model to better articulate the complexity of Bitcoin adoption at the individual level. Our work can be considered as an attempt to fill the research gap by providing a footstone for further theoretical development. Future research can extend our work by developing a survey using objective measures of constructs and their dimensions, conducting a confirmatory factor analysis, and testing the proposed model empirically to determine its explanatory power.

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