CONSUMER ADOPTION OF BITCOIN IN E-COMMERCE

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CONSUMER ADOPTION OF BITCOIN IN E-COMMERCE

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by

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DECLARATION OF ORIGINALITY

I, Serhat Serhatlı, certify that

- I am the sole author of this thesis and that I have fully acknowledged and documented in my thesis all sources of ideas and words, including digital resources, which have been produced or published by another person or institution;
- this thesis contains no material that has been submitted or accepted for a degree or diploma in any other educational institution;
- this is a true copy of the thesis approved by my advisor and thesis committee at Boğaziçi University, including final revisions required by them.

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ABSTRACT

Consumer Adoption of Bitcoin in E-Commerce

Bitcoin has recently brought disruptive innovation into the financial system. While it is considered as an investment instrument by many, its adoption as a payment mechanism particularly in e-commerce has been scarce. Nevertheless, many e-commerce sites are considering or experimenting with it as a payment mechanism. However, the content analysis made in this thesis to identify trends and research gaps in this field shows that academic literature on the perceived benefits and risks of cryptocurrency adoption is limited. In fact, there is no prior study about cryptocurrency adoption in e-commerce payments. Accordingly, this thesis aims to explore cryptocurrency adoption in the e-commerce context to fill this gap. The cryptocurrency adoption in the e-commerce context is explored through the diffusion of innovation theory, which is expanded with perceived security, ubiquity, financial risk, and the legal risk constructs. Data is collected from 208 respondents via an online survey with convenience sampling. Frequency, crosstab, reliability, confirmatory factor analyses and partial least square estimations were conducted over the data. The results show that relative advantage, compatibility and perceived security significantly explain cryptocurrency adoption in e-commerce. In addition to that, ubiquity and trialability were significant predictors of perceived security. Finally, managerial implications are discussed for designing customer experience in cryptocurrency payments.

ÖZET

E-Ticarette Bitcoin Kullanımının Tüketiciler Tarafından Benimsenmesi

Bitcoin son yıllarda finansal sistemimize yıkıcı bir inovasyon getirdi. Birçok kişi tarafından bir yatırım aracı olarak değerlendirilirken, bir ödeme aracı olarak benimsenmesi özellikle e-ticarette oldukça sınırlı kaldı. Bununla beraber birçok e-ticaret sitesi de Bitcoin'i ödeme aracı olarak kullanmayı göz önünde bulunduruyor veya deniyor. Bu tezde yapılan içerik analizi Bitcoin üzerinde yapılan araştırma trendlerini belirleyerek hangi alanların halen keşfedilme ihtiyacı olduğunu ortaya koymuş olsa da akademik literatürde kripto para benimsenmesindeki algılanan fayda ve riskler hakkındaki kaynakların oldukça az olduğunu göstermiştir. Hatta e-ticaret özelinde hiç kaynak bulunmamaktadır. Bu boşluğu doldurmak için, bu tez çalışmasında e-ticarette Bitcoin kullanımının tüketiciler tarafından benimsenmesinin önündeki faktörlerin yeniliklerin yaygınlaşması teorisi kullanılarak keşfedilmesi amaçlanmıştır. Teori, algılanan güvenlik, aynı anda her yerde bulunma, finansal ve hukuksal risk değişkenleri ile zenginleştirilmiştir. Çevrimiçi bir araştırma anketi yapılarak kolayda örnekleme yöntemiyle 208 kişiden yanıt toplanmıştır. Toplanan yanıtlar frekans, çapraz tablo, güvenilirlik, faktör ve kısmi en küçük kareler yöntemleriyle analiz edilmiştir. Sonuçlar göreceli üstünlük, geriye uyumluluk ve algılanan güvenlik faktörlerinin benimsenme üzerinde etkisi olduğunu ortaya koymuştur. Buna ek olarak aynı anda her yerde bulunma ve denene bilirlik faktörlerinin algılanan güvenliği açıkladığı görülmüştür. Tez çalışmasının bitiminde yöneticilerin kripto para ödemelerinin müşteri deneyimlerini nasıl tasarlamaları gerektiği yönünde tavsiyeler verilmiştir.

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CHAPTER 1

INTRODUCTION

The digital economy has taken a new turn with the emergence of bitcoin, which is a cryptocurrency that is produced, stored and transferred digitally. When the first bitcoin transaction took place in 2009, little was known about what it was and how it would be used. Over the years, Bitcoin has gained momentum rapidly. As of 2014, nearly half of the U.S. public was aware of Bitcoin (PwC, 2014). In an interview with Erik Schatzker of Bloomberg's "Street Smart," Bill Gates commented on Bitcoin as "Bitcoin is better than currency in that you don't have to be physically in the same place and of course for large transactions currency can get pretty inconvenient" (Gates, 2014).

As Adam Smith says, "All money is a matter of belief." That can also be applied to Bitcoin. Bitcoin is valuable only because users believe it to be valuable (Christopher, 2014). Trust is the main reason that takes Bitcoin beyond technological innovation quickly in a short time. In 2008 economic crises, 25 banks failed in the USA and in following years many others continued to declare bankruptcy (Federal Deposit Insurance Corporation, n.d.). Trust in the financial institutions were weakened. Bitcoin first appeared in 2009 right after this trust crisis.

Bitcoin is a cryptocurrency that works on Blockchain, which is essentially a public ledger technology. Blockchain challenges how information is stored and shared anonymously in many sectors ranging from health to financial services. As its integrity and the chronological order are enforced with cryptography (Meijer, 2015), it provides both transparency and security at the same time. Bitcoin works peer to peer for transferring money with very low fees or without fees, challenging the value

proposition of banks. In a report of PwC (2014) it is mentioned that “Bitcoin becomes new payment system because it has no transaction fee and decentralized peer-to-peer payment system can be shielded from fluctuations caused by local government politics and their influence on central banks”. In this regard, Bitcoin is becoming an open-source monetary system solving the double-spending problem and security issues via encryption.

Accordingly, the ability to eliminate intermediaries in the financial system and protect the value of money from political instabilities increased the popularity of Bitcoin and it became a prominent digital currency in just a couple of years. While the academic debate continues whether it may replace fiat currencies in the long term, it starts to bear more resemblance to them as a medium of exchange.

1.1 Bitcoin and Blockchain

The best way to understand how bitcoin does work is by looking at how a bitcoin is transferred over the network. Typically, users have digital wallets where their bitcoins are kept and use their wallets to send money between each other by typing just amount, and destination bitcoin account address then clicks send button. Although it seems as easy as sending an email, there is a vast technology called Blockchain behind it.

In theory, Blockchain is just a public ledger with account numbers and balances. When a person sends one Bitcoin to someone, the sender’s balance goes down by one and the receiver’s balance up by one. What is backing these figures are no physical asset or institution such as gold or government but trust. These numbers are meaningful because people believe in a system, which is invulnerable to be manipulated by third parties. System guarantee that money cannot be spent on

someone else's account. Whenever you start a transaction in your wallet, you broadcast a message with amount, source, and destination account information to the public ledger and say how it should change.

If the ledger is public, someone could create a fake transaction. In fact, this is not possible because of the private key signature, which is used with the same purpose as on a paper check; it proves that the genuine account owner created an order of payment. By a slight difference, in bitcoin, this signature is made from single-use; encrypted math-based function rather than handwriting.

Each bitcoin account number has a private key, which is only known by the actual account owner. The account owner uses this key to create signatures by encrypting the whole transaction message then send a sealed message to the receiver by broadcasting it to the blockchain. Every message in bitcoin is encrypted. It is one of the most powerful features of blockchain. After sender broadcasts its encrypted message to the blockchain, miners race for decrypting these messages by solving a hash algorithm. Once they achieve, they prove the validity of the transaction.

Besides cryptography, another most potent feature of Blockchain is that it is decentralized, which means no single person, company, or government is controlling at the back end. When you broadcast a message to the blockchain, this message is spread to all the people who want to help to maintain the ledger. Each person has a personal copy of the ledger and updates it whenever they get a new message with a valid signature. Due to this trademark of Blockchain, traffic delays and uncommonly fraud can result in differences between those copy ledgers. The "voting" system is then used to decide which version of the ledger is the correct one.

Different from a traditional voting system, which is applied in democratic countries. It is a little bit different in Bitcoin. To vote, miners who are responsible for

maintaining ledger must solve a hard math problem based on their ledger's version. The first person who solved the problem announces their solution, and everyone updates their version with solved one. So, voting turns into a mathematical race. If anyone can win the race, get his or her reward as bitcoin from blockchain this is the way of mining new money. This math problem can only be solved with the computational power of users. In other words, it needs electricity to be solved.

After voting which determined the correct version of the ledger, transaction information is written to ledger then sender's money is transferred to the receiver successfully.

In summary, Bitcoin is a digital currency that is written in a collaboratively maintained ledger in an encrypted format. When people transfer money to somebody, they create a message that includes destination address and amount of money then send it to maintainers who make sure that the messages are coming from the valid account owners by checking digital signatures. Finally, the maintainers reach consensus with each other through a math-based voting process. Six years ago, Bitcoin was just innovation in information technology, but now it is used to buy goods and services and has become an investment on its own.

1.2 The purpose of the thesis and research questions

The thesis consists of two studies. Each study has a research problem and methodology.

The first study is about examining research fields of bitcoin and their changes over time by content analysis research methodology. As the Bitcoin is a new multidisciplinary research area, a content analysis is conducted to see what research

areas were deliberated so far before identifying the main research question. Therefore, the first study is aimed to explain the following research question;

RQ_1: “What research fields were studied so far about bitcoin and how these topics changed over time?”

After the first study, it was seen that the consumer adoption part of Bitcoin in the e-commerce context had not been studied yet. Therefore, in the second study, consumer adoption of Bitcoin in e-commerce was chosen as the major research point. Therefore, the research question of the second study is as follows;

RQ_2: “What are the factors which affect consumer adoption of using bitcoin in e-commerce?”

CHAPTER 2

CONTENT ANALYSIS OF BITCOIN LITERATURE

There has been a notable increase in Bitcoin-related research over the past years, and it continues to increase as it disrupts the financial services industry. Accordingly, looking at the articles published in scholarly journals can provide understanding about how the literature of Bitcoin has changed. In this study, the articles published between 2011 and 2016 are analyzed through content analysis research methodology to reveal the evolution of Bitcoin. According to Weber (1990, p. 117), "Content analysis is a research method that uses a set of procedures to make valid inferences from the text". The purpose of this content analysis is to set the light on the progress of Bitcoin in academic research. In this chapter, the first research question, which is "What research fields were studied so far about bitcoin and how these topics changed over time?" is examined. This pre-study was conducted to find the main research subject before starting this thesis. Hence, only articles, which were published until the year 2016, were analyzed in this study.

2.1 Literature review

The literature on Bitcoin is considerably limited in comparison with other contemporary research topics. However, it has been growing progressively because of Bitcoin's multidisciplinary nature in terms of economics, security, law and computer science.

From the perspective of economics, some researchers focused on the sustainability of Bitcoin to prove whether it would be an alternative monetary system. Saito (2014) mentioned that if the inflation rate and credibility issues are

solved, Bitcoin could be used beside traditional money. In one-step further, according to Singhal and Rafiuddin (2014), Bitcoin has the potential to replace traditional money. In order to do that, firstly it must evolve into a more secure form of money. Liaising with other forms of online payment and involving the government in insurance policies for protection against theft, are suggested steps for Bitcoin to grow out of its volatile stage.

Another stream of economics literature studied the value of Bitcoin by investigating factors, which determine the price of Bitcoin. Mostly as in other fiat currencies, the answer comes about usage rate as well as trust. Bjerg (2015) stated that the US dollar is valuable because, it is used as a world reserve currency by many countries. If countries would give up using the US dollar then its value is likely to drop dramatically. From this point of view, there is essentially no difference between Bitcoin and the US dollar or any other national currency for their value.

Since Bitcoin is a worldwide used global currency, some researchers highlighted Bitcoin as an alternative payment system, which has very low transaction fee. Angel and McCabe (2015) indicated that as Bitcoin has low transaction fee, people could prefer Bitcoin for international transactions to avoid high transaction fees. This feature would be a good option for poor migrants who send money to their family from abroad. Furthermore, according to Thomas and Rudman (2016), they claimed that Bitcoin has potential to facilitate a financial revolution in Africa because the physical location of the sender and receiver of a bitcoin transaction does not affect the transaction costs or the speed of the transaction. This feature also helps to facilitate cross-border transactions and creates an opportunity for companies to enter new global markets and gain access to new potential customers in emerging markets, where credit cards are not offered, or financial infrastructure does not exist.

Since the price of Bitcoin has been an increasing steadily for years, some researchers studied Bitcoin as an investment instrument. Dyhrberg (2016) suggests that Bitcoin can be used for hedging against stock exchange alongside with gold to eliminate or minimize market risks.

Bitcoin comes with its robust encryption technology called Blockchain, which brings cryptocurrencies into the forefront among fiat currencies. To dive deep into this technology, some researchers chose to study the security perspective of Bitcoin by examining Blockchain. Some of them studied proving anonymity while transferring money, which is one of the biggest promises of Blockchain. While Koshy et al. (2014) mention it may be possible to identify who the sender and receiver are with the help of some techniques, Bonneau et al. (2014) showed alternative protocols to strengthen anonymity by hardening traceability of transactions. In addition to that, attack scenarios against Blockchain network such as 51% attack and denial of service attacks were also studied in researches.

In the regulatory aspect, some researchers focused on the legal status of Bitcoin. According to the study of Turpin (2014), presently Bitcoin does not seem illegal under existing laws in nearly every country, and suggests that governments should not declare Bitcoin as an illegal asset, it is not an argument against regulation. Moreover, in the study of Ajello (2015), the author mentioned that money-laundering issues of Bitcoin is seen more dangerous by regulators and law enforcement officials while entrepreneurs and investors are worried about value and stability of Bitcoin. On the other hand, since trading of Bitcoin is getting popular, taxing of Bitcoin both from transactions and from trading has been another research topic.

2.2 Phases of content analysis

The six-phases of content analysis are shown in Fig. 1. The first step is selecting the sample in which the author identifies the text and selects the sample. The second phase is specifying the unit of analysis. In that phase, the author specifies the themes from each article. The third phase is determining the category schema in which the categories are identified by coders from themes. The fourth phase is the selection of final categories. In this stage, judges are assigned to select final categories from the category schema. In the fifth stage, reliability analysis is done to test the robustness of analysis with Cohen's Kappa. In the end, the author analyses the collected data and interpret the results (Bayramusta & Nasır, 2016).

2.3 Selecting sample

The sample of the study consists of 130 academic articles published over the six years, from 2011 to 2016. The databases scanned through the library search facilities include ABI/INFORM complete, Ebsco, Emerald, and Proquest. These databases have journals with different disciplines. The sample was selected from articles, which published on scholarly reviewed journals and the title of articles contain any of the following phrases; "bitcoin", "cryptocurrencies", "cryptocurrency", "digital currencies" or "digital currency".

2.4 Specifying the unit of analysis

All articles from the selected sample were consolidated in a table according to their database, title, author, year, journal, and abstract. Then the title and abstract of all articles were read by the author to determine a theme, which covers the primary

purpose of the article. In the end, those themes were selected as a unit of analysis in this content analysis.

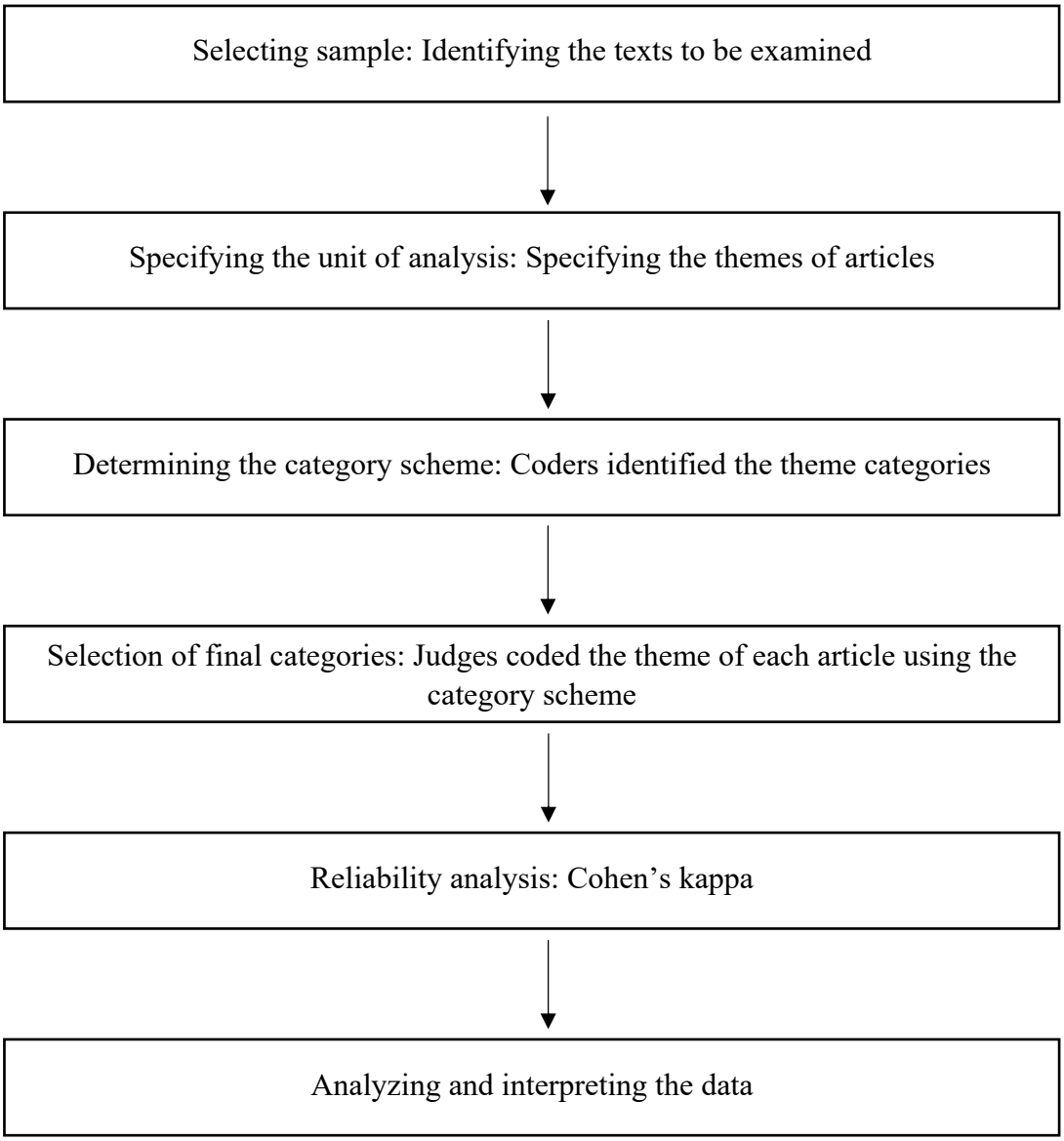

Fig. 1 Phases of content analysis (Bayramusta & Nasır, 2016)

2.5 Determining the category scheme

Two Ph.D. candidates, who have been studying both in the Department of Management Information Systems and working at the IT industry, were selected as coders to read the themes and come up with categories. Initially, they were trained by

ten randomly selected themes to ensure making the classification process more reliable. As a result of training, conflicts between coders were argued and resolved. After training was finished, coders were asked to group all themes into categories, which are independent, few, and broad. Coders were free in determining categories and had no restriction in a number of them while creating. Ultimately, 16 categories were generated from 130 themes by two coders shown in Table 1.

Table 1. Generated Categories by Coders

Coder 1	Coder 2
• Analysis of Bitcoin transaction data and network • Application of Bitcoin on various context • Evaluation of Bitcoin • Evolution, characteristics, and usage of Bitcoin • Examining price of Bitcoin and its Effects • Regulatory and governmental issues of Bitcoin • Risks of Bitcoin • Security and privacy issues of Bitcoin • Tax-related issues in Bitcoin	• Regulations and legal issues • Privacy • Technical issues • Market dynamics • Financial literacy • Digital economy • Security

2.6 Selection of final categories

The researcher evaluated all the 16 categories, which were collected from coders, and six mutually exclusive and exhaustive final categories are selected;

1. "Economic dimension of Bitcoin" category: Analyzing Bitcoin's impact on (i) economic development, (ii) creation of alternative monetary, payment, and financial systems and (iii) its adoption by users.
2. "Application of Bitcoin technology in a different sector" category: Usage/modification of bitcoin technology infrastructure, mostly blockchain, in different sectors such as health industry.

3. "Security dimension of Bitcoin" category: security, privacy, anonymity, cryptography, certification, protocols and validation issues of bitcoin technology.
4. "Price and risk dimension of Bitcoin" category: Evaluation of investing and trading bitcoin as a currency, valuation, and risks of bitcoin such as speculation and price bubbles, crisis, inflation risk, usage of bitcoin in risk management.
5. "Regulatory and legal dimension of Bitcoin" category: legal framework and compliance issues such as lack of regulation, fraud, criminal activity, taxes, money laundering, and financial regulation.
6. "Technical dimension of Bitcoin" category: architectural design of Bitcoin in a technical manner.

2.7 Reliability analysis

In order to measure the reliability of categories, three judges with doctorate degrees in management information systems were assigned to make reliability assessment. They were asked to assign final categories, which were selected the last stage to each of the 130 themes. Even though there are several ways to measure reliability, the quickest way is to look pairwise percentage of agreement among judges in assigning the same themes to the same categories in Table 2.

Table 2. The Percentage Agreement of Judges

Judges	Number of Matching (out of 130)	Percentage
A and B	98	76%
A and C	92	71%
B and C	102	79%

According to Grayson & Rust (2001), percentage agreement between judges is not enough to see real agreement because of the chance factor and few numbers of categories. Thus, a reliability analysis should be conducted by calculating Cohen's K for robustness according to the directions in the study of Grayson & Rust.

$$K = \frac{p_a - p_c}{1 - p_c}$$

Where p_a is the proportion of agreed on judgments$\left(p_a = \frac{(n_{11} + n_{22} + \cdots + n_{77})}{n_{++}}\right)$; p_c is the proportion of agreements one would expect by chance $\left(p_c = \frac{(e_{11} + e_{22} + \cdots + e_{77})}{n_{++}}\right)$ and $\left(e_{ii} = (\frac{n_{i+}}{n_{++}})\ x\ (\frac{n_{+i}}{n_{++}})\ x\ n_{++}\right)$

It was found that Judge A and B are in agreement with 0.68 kappa score, judge A and C are in agreement with 0.64 kappa score, and judge B and C are in agreement with 0.73 kappa score. According to Landis & Koch, and Altman, substantial agreement between judges was found (Landis & Koch, 1977) (Altman, 1990).

2.8 Research findings

The number of articles over six years is illustrated in Fig. 2. In the beginning, only two articles were published in the years 2011 and 2012. Next year as bitcoin becomes more popular number of papers published climb up to 12 articles. There has been an almost four-fold increase from 2013 to 2014 as the total number of articles reached 40. After a slight shortfall in 2015 with 32 articles, research on Bitcoin accelerated dramatically and reached 44 papers in 2016. The change of article numbers per year is displayed in Table 3. It is obviously seen that in recent years, the number of researches has increased significantly.

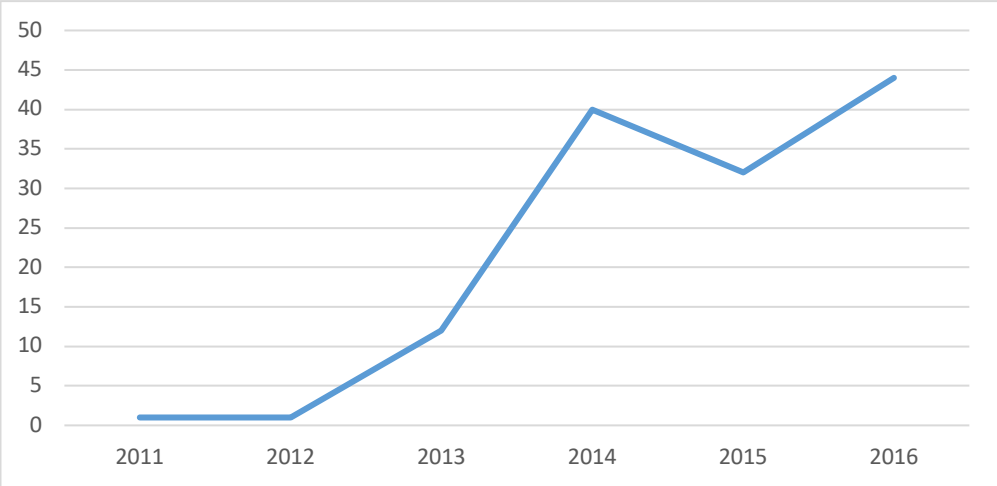

Fig. 2 The number of articles over six years

Table 3. The Number of Articles per Year

Year	Count of Article
2011	1
2012	1
2013	12
2014	40
2015	32
2016	44
Total	130

2.8.1 Theme analysis

Fig. 3 displays the result of the theme analysis in six different categories. The pie chart also shows the percentage of articles by themes. According to data, "Economic dimension of Bitcoin" (31%) is the most explored theme over six years. Economy-related subjects were covered mainly under this theme. Bitcoin was studied as an alternative financial system (Ciaian, Rajcaniova, & Kancs, 2016), or as an alternative investment vehicle (Hong, 2016). This theme is followed by "Regulatory and legal dimension of Bitcoin" (23%), which is the second most studied theme over six years. All legal issues were studied in this theme such as money-laundering (Simser, 2015),

taxing (Kowalski, 2015), regulation (Ly, 2014). Another strong theme among 130 articles is “Price and risk dimension of Bitcoin” (21%). In this theme, price formation of bitcoin is studied mostly (Cheah & Fry, 2015). Besides that, the risk dimension (Moore T. , 2013) and adoption (Pakrou & Amir, 2016) are studied. Although privacy is seen as the most advantageous point of Bitcoin “Security and privacy dimension of Bitcoin” (18%) is ranked fourth among six themes. Anonymity is studied under this theme (Ober, Katzenbeisser, & Hamacher, 2013). Moreover, the security aspect of Bitcoin is also studied in this theme (Houy, 2014). As blockchain becomes more mainstream, its application in different sectors is also studied by researchers (Zhang & Wen, 2016). Therefore, the theme “Application of Bitcoin technology in a different sector” ranked fifth (4%). “Technical dimension of Bitcoin” (3%) is ranked at last. The topics under this theme mostly about the core of the Bitcoin protocol and its applications (Tschorsch & Scheuermann, 2016). The detailed information is provided with the total number of article numbers per themes in Table 4.

For identifying possible change and trends, the number of articles by their categories are shown in Table 5 yearly. In the year 2011, and 2012, only two categories, which are “Economic dimension of Bitcoin” and “Security and privacy dimension of Bitcoin” were studied with two articles, which are about measuring the possible impact of bitcoin on the economic system and developing a more secure protocol to protect bitcoin transactions. Because the concept of Bitcoin was newly introduced, it has not come into prominence in academic researches, so this result was expected.

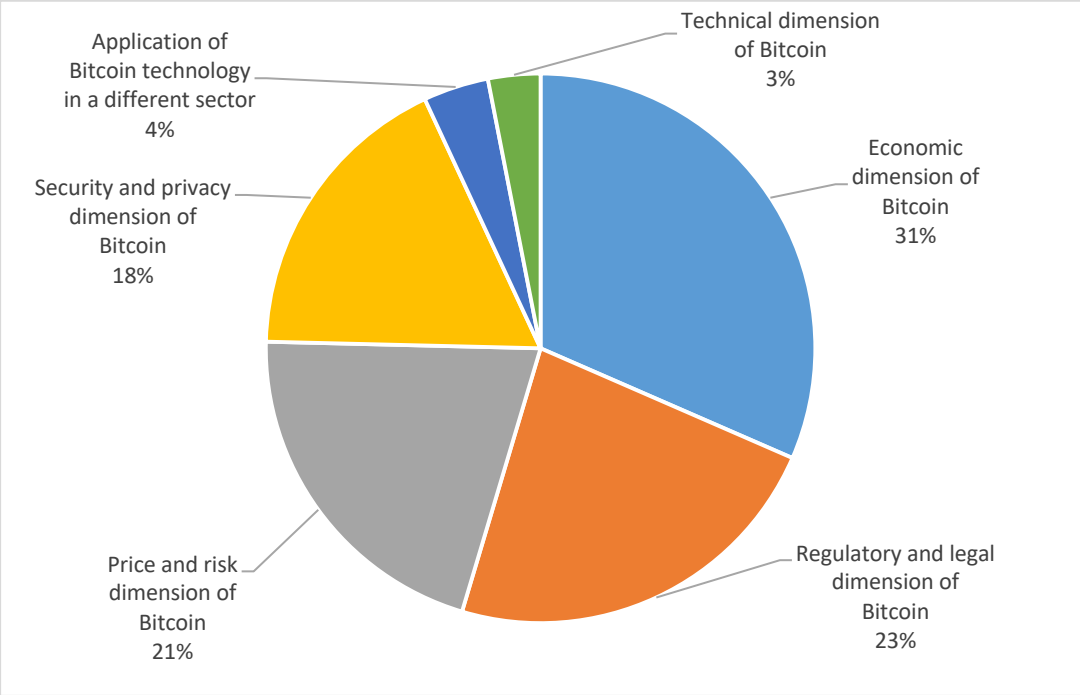

Fig. 3 Percentage of articles by theme

Table 4. The Number of Articles per the Theme

Theme	Frequency of Article	% of Article
Economic dimension of Bitcoin	41	31%
Regulatory and legal dimension of Bitcoin	30	23%
Price and risk dimension of Bitcoin	27	21%
Security and privacy dimension of Bitcoin	23	18%
Application of Bitcoin technology in a different sector	5	4%
Technical dimension of Bitcoin	4	3%
Grand Total	130	100%

Researchers increasingly continued to focus on economic, security, and privacy issues of bitcoin in 2013 compared to the previous years. At the same time, they also started to seek which factors affect the value of Bitcoin. Therefore, in this year, “Price and risk dimension of Bitcoin” appeared for the first time with three articles. Since the implementation of using bitcoin turned into practice from theory, the researchers began to examine how bitcoin can be regulated in our monetary

system, therefore “Regulatory and legal dimension of Bitcoin” was leading category with four articles of 12 in the year 2013.

Table 5. Summary of Theme Analysis for Each Year

Theme	2011	2012	2013	2014	2015	2016	Total
Technical dimension of Bitcoin	0	0	0	1	1	2	4
Application of Bitcoin technology in a different sector	0	0	0	0	2	3	5
Security and privacy dimension of Bitcoin	0	1	3	13	3	3	23
Price and risk dimension of Bitcoin	0	0	3	3	10	11	27
Regulatory and legal dimension of Bitcoin	0	0	4	12	6	8	30
Economic dimension of Bitcoin	1	0	2	11	10	17	41
Grand Total	1	1	12	40	32	44	130

After the end of 2013, when the bitcoin price exceeded 1.000$, interest in bitcoin increased in 2014 on the side of academic researchers. The total number of articles increased dramatically more than trifold to 40. In this year, “Technical dimension of Bitcoin” was studied for the first time with one article. The highest increase was on “Economic dimension of Bitcoin,” which jumped from two to 11 articles. Same tremendous growth was seen in security and related regulatory studies, respectively.

In 2015, blockchain became prominent in industries, which are interested in using blockchain. Consequently, “Application of Bitcoin technology in a different sector” was analyzed by researchers for the first time in 2015. Surprisingly, after the price of bitcoin peaked at the end of 2013, its value decreased continuously in 2014 and 2015, this situation guided researchers to do more studies about price and risk issues. Thus, “Price and risk dimension of Bitcoin” was the leading category in increasing rate for the year 2015. As of 2015, it is understood that security and

privacy issues were no longer attention-grabbing categories for researchers. However, other categories keep their popularities.

As time passes by, usage of bitcoin has been increasing over the world. Therefore, the category “Economic dimension of Bitcoin” maintained its popularity in 2016, which can be analyzed deeply in Fig. 4.

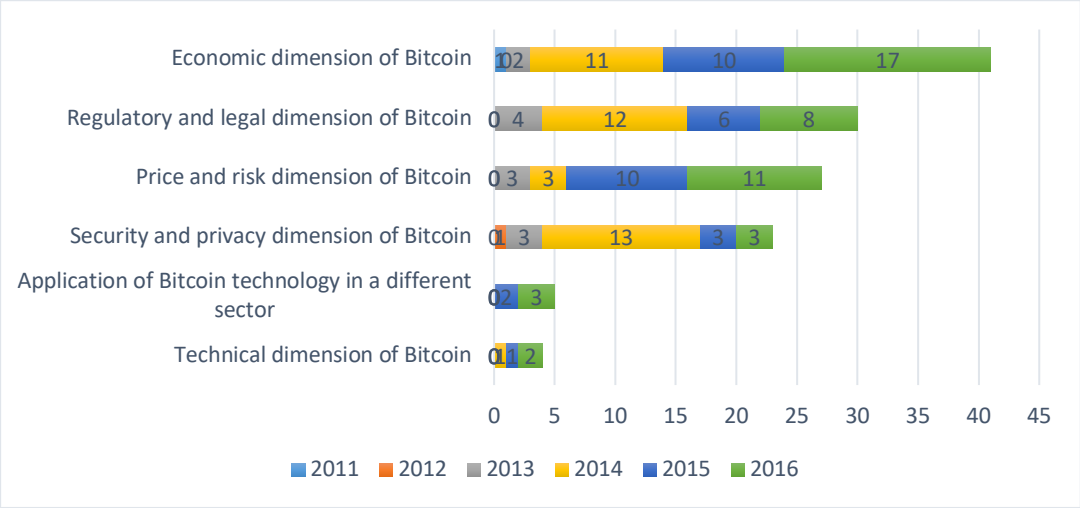

Fig. 4 Theme analysis of 130 articles over the years

Fig. 5 displays the change and trend analysis of themes over the years. Even though it had a slight fall in 2015, the theme “Economic dimension of Bitcoin” had a significant rise between 2013 and 2016 years. The overall trend was similar with “Price and risk dimension of Bitcoin” dimension except for 2013-14 period where “Price and risk dimension of Bitcoin” theme remained constant. The trend was reversed between 2014 and 2015 years, in those years “Economic dimension of Bitcoin” theme slowed down, while research on “Price and risk dimension of Bitcoin” theme increased threefold.

Although “Application of Bitcoin technology in a different sector” had no popularity at the beginning, it started to increase after 2014. This result was expected because the benefits of bitcoin technology in terms of anonymity and security were

more recognized. Hence, in parallel with that, “Technical dimension of Bitcoin” theme also gained attention of researchers after 2014.

Regulation is not only a barrier against merchants who are willing to use bitcoin in their payments but also a protection for users who are willing to use, store, and transfer their bitcoins. Therefore, the theme “Regulatory and legal dimension of Bitcoin” will always be an issue which needs to be solved by researchers. Overall, the research has accelerated except for the 2014 and 2015 period.

Anonymity and privacy are one of the compelling advantages of bitcoin. Plenty of studies has been made about identifying the strength of bitcoin protocol, detecting attacks, and double-spending issues between 2011 and 2014 year. However, the research on “Security and privacy dimension of Bitcoin” theme decreases after 2014 as research in this field matures.

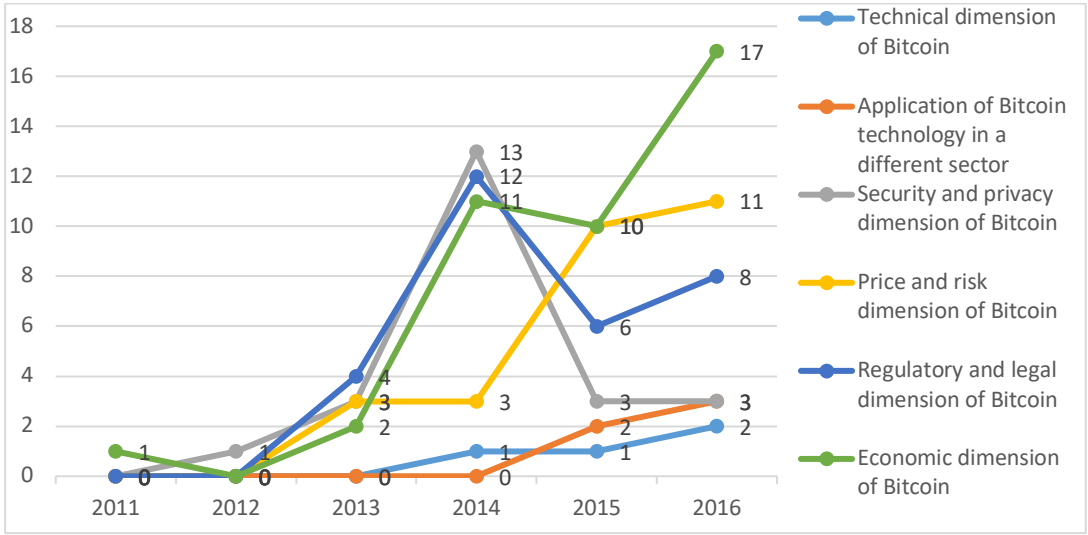

Fig. 5 Change and trend analysis of themes over the years

2.8.2 Journal analysis

The articles are analyzed according to their journals in this step. The journals, which have only one article grouped as “Others” and the rest of them, grouped according to

their journal names. Fig. 6 shows the result of journal analysis. According to the journal analysis results; the journals "Lecture notes in computer science" published 14 and "PloS one" published seven articles for six years and reached the highest share among 130 articles. Furthermore, "Applied Economics" shared third place on the list with a group of finance and economics journals. The rest of the articles are mostly published in journals of law and internet.

Fig. 6 Number of articles per journal

Table 6 shows journals with their publication counts about Bitcoin context over the six years the number of articles in detail that were published in each journal over the six years. Even though "Lecture notes in computer science" has taken the first place, it is seen that in recent years no article is published in this journal. Rather than that, "PloS one" has an increasing number of articles in the last two years. Following these top CS journals, the journals published in the area of finance and regulations dominate publications as of 2016.

Table 6. Summary of Journal Analysis for Each Year

Journal	2011	2012	2013	2014	2015	2016	Total
Others	1	0	7	17	20	27	72
Lecture Notes in Computer Science	0	1	2	11	0	0	14
PloS one	0	0	1	1	3	1	6
Applied Economics	0	0	0	0	3	1	4
Finance Research Letters	0	0	0	0	0	3	3
Economics Letters	0	0	0	0	1	2	3
Banking & Financial Services Policy Report	0	0	0	1	0	2	3
Journal of Internet Banking and Commerce	0	0	0	1	0	2	3
Banking & Finance Law Review	0	0	0	1	0	2	3
Theoretical and Applied Economics	0	0	0	2	1	0	3
Cambridge Journal of Economics	0	0	0	0	1	1	2
New England Law Review	0	0	1	1	0	0	2
Cato Journal	0	0	0	0	2	0	2
Future Internet	0	0	0	1	0	1	2
IT Professional	0	0	0	1	0	1	2
CES Working Papers	0	0	0	2	0	0	2
Accountancy SA	0	0	0	1	0	1	2
Computer Fraud & Security	0	0	1	0	1	0	2
Grand Total	1	1	12	40	32	44	130

2.9 Discussions and conclusion

Although, virtual currencies have already been in our life for a long time with different forms like a point in credit cards, poker chip in virtual gambling, a sellable item in a role-playing game, none of them was as successful as bitcoin, which evolved to a separate currency. The root cause was that each currency has a centralized authority who is responsible for the money supply and could be in different forms like a country, a man, an institution. However, in 2009, Bitcoin has come and changed the rules by taking authority from a single point than giving it to all people around the world. Because people got a taste of freedom in producing money, contributing to the development of a currency whose source code is open for

everyone, determining the value of a currency, Bitcoin has quickly become popular in the past ten years.

It was released in 2009, but first two years it did not catch so much attention. During the initial years Bitcoin was considered as money, which can be produced by mining and exchanged. Main attention was on mining and selling Bitcoin, other dimensions were overlooked.

In the following years bitcoin miners grew their business from personal computers to ASIC hardware, which is a computer specialized in Bitcoin mining. However, people who lacked knowledge about storing Bitcoin securely and transferring it anonymously, suffered from hacking and lost their money. Eventually security and privacy dimensions became more important.

Nevertheless, as interest in Bitcoin continued to soar, not only producers but also merchants started to notice Bitcoin. As a result of this, in October 2013, the world's first Bitcoin ATM Launched in Canada (Liljas, 2013). After this year, overall attention on Bitcoin instantly increased in both academic types of research and people.

Researchers started to study Bitcoin by looking at different aspects. A good number of academic research were conducted in the area of regulation and integration of Bitcoin in the current law system, measuring risks for investment, determination of factors which affected on the Bitcoin's price, potential impacts on the current financial/ economic/monetary system.

As of 2015, financial institutions started paying attention to the blockchain technology. Notably, the banks started to explore ways to use blockchain in their infrastructure to cut money transfer fees down. In accordance with Industry 4.0 the interest in IoT devices accelerated in 2016, which also led the value of blockchain to

become more noticeable. Therefore, application of bitcoin technology in different sectors got more popular in recent years along with the technical dimension of Bitcoin. While technology itself is gaining more interest, the volatility of bitcoin continues to be a problem for its adoption as a medium of exchange.

In conclusion, it is evident that bitcoin is growing in the public eye. It will appear more and more in the future with new research dimensions. Even though plenty of studies were made over six years, there are still unclear areas, which need to be enlightened in the future. One of them is consumer adoption issue. Since previous studies about Bitcoin have focused on security, privacy, trust and regulation dimensions, which are part of adoption dimensions as well, the consumer adoption area should be analyzed to identify the adoption factors, and necessary actions should be suggested to remove barriers against adoption for ensuring mainstream adoption.

CHAPTER 3

CONSUMER ADOPTION OF BITCOIN IN E-COMMERCE

As digitization in every aspect of our lives continue, it is evident that one day fiat money may be replaced by a digital one. Bitcoin pioneers this transition process with its decentralized blockchain technology. However, while "Economic dimension of Bitcoin" is the most studied theme by academia which is the result of our content analysis research in chapter one, there is a lack of knowledge about the adoption of Bitcoin by consumers.

To fill this gap, in this chapter, the adoption of Bitcoin is studied from a consumer perspective in e-commerce context. Firstly, literature is reviewed to understand the status of researches in the area of bitcoin adoption. It is followed by the discussion of existing adoption theories, which may help us to shape our research model. After that, hypotheses are developed, which are based on the theoretical framework. Later on, hypothesizes are tested with the help of an online survey. This research closes with a discussion of findings and conclusion section in that, main drivers that lead consumers to adopt bitcoin are discussed, and future insights are given for enhancement of this research area.

In this research, the term "cryptocurrency" and "Bitcoin" are used interchangeably since Bitcoin is the most well-known, most highlighted cryptocurrency with the highest market capitalization more than 170 billion USD (see Table 7 for the top five cryptocurrencies according to Coinmarketcap (2018)).

Table 7. Market Capitalization of Top Five Cryptocurrencies

Name	Market Cap	Price
Bitcoin	$174.511.894.083	$10.333,60
Ethereum	$84.871.095.304	$867,27
Ripple	$37.492.853.577	$0,959024
Bitcoin Cash	$21.289.655.699	$1.253,15
Litecoin	$12.244.841.139	$221,06

3.1 Literature review

There are plenty of researches about the adoption of new technologies. However, if the subject is Bitcoin, framing it simply as new technology adoption would be an understatement. Because Bitcoin is not only new technology, it is a candidate for an alternative financial system (Weber B. , 2015). For instance, there is a stream of research about the adoption of mobile wallet technologies. This topic can be thought similar because Bitcoin can be used as a mobile wallet, but the assessment of Bitcoin only as a mobile wallet would be misleading since it is also a digital currency. Hence, in this literature review, the researches that focus only on adoption of Bitcoin or cryptocurrencies are reviewed. In the literature, there are just a few researches about this topic. Therefore, all of them are elaborated in this section. The adoption theories, which are mentioned during the literature review, are discussed in the next section.

In the research of Baur, Bühler, Bick, & Bonorden (2015), perceived advantages and disadvantages of Bitcoin are studied in comparison with other methods of electronic payment such as credit cards, and PayPal. Furthermore, drivers and barriers against the adoption of Bitcoin are studied with an exploratory interview

approach by looking from expert, merchant and user perspectives. Moreover, the authors evaluate Bitcoin's future potential as a disruption of society, asset, unit of account and currency. In this research, 13 people are separated according to their Bitcoin usage roles as Consumer, Merchant, and Bitcoin exchange group, which consists of individuals who work at Bitcoin exchange companies. After that, questions are asked to measure perceived usefulness and ease of use with the help of the Technology Acceptance Model. The result of this study shows that, perceived ease of use is still low in all user groups. Consumers see Bitcoin and mobile wallets in general, challenging to use. Consumers expect more user-friendly interfaces in offline stores. From the merchants' point of view, they think accepting Bitcoin payment is not a technical, but rather a societal challenge. Furthermore, Merchants see the volatility of Bitcoin's price as the main threat. According to exchange group members, the cryptographic technology behind Bitcoin is too complex to understand by consumers and merchants. For perceived usefulness, consumers evaluated security features and anonymity of Bitcoin very high. Moreover, the lower costs are seen as the primary argument for using Bitcoin in wire transfer use cases. As for merchant user group, anonymity and security are not a paramount concern; the most critical argument for merchants sees the amount of money immediately on their accounts with paying low transaction fees. From the point of view of Bitcoin exchange staff group, their concern about usefulness is security. They think that security will become an increasing problem soon so that there has to be a more secure payment method which can be solved by eliminating fraud with Bitcoin. In terms of subjective norms consumers see Bitcoin very innovative and think that Bitcoin makes mobile payment attractive. Merchants see that Bitcoin can make competitive advantage as an excellent payment method to catch techie consumers.

As Bitcoin exchange group members, they think payment with Bitcoin will be more part of our lives in the future through increased word-of-mouth between users. The potential of Bitcoin looks quite bright by all research groups. However, they state that recognition and penetration level is too low.

In the research of Schmidt, et al. (2016), empirical insights about the benefits of using Bitcoin are provided. A quantitative research study was realized. Firstly, the determinants, which effects using Bitcoin, are found from previous studies. These determinants are specified as safety, community, usability, decentrality, acceptance, and transfer velocity. After that for each determinant, six hypotheses are developed. The results show that the transaction speed and wider acceptance through higher dissemination has a positive impact on the benefit of using Bitcoin. For decentrality, the users see bitcoin as a trade free currency, which does not depend on any authority, bank or government. Surprisingly, the hypothesis about usability was not shown significant after analysis. So that impact of usability on the benefit of using Bitcoin was not confirmed. The effect of the community was confirmed that the bigger and stronger Bitcoin community has more impact on the benefit of using Bitcoin. The last determinant safety is also confirmed that users expect their privacy to be kept secure.

Nair & Cachanosky (2017) stated that the barrier against the adoption of Bitcoin is rarity of options to spend bitcoins. Although there are some intermediary institutions, which help merchants for accepting Bitcoin payments easy, there should be more incentives to attract consumers for paying with Bitcoin like getting a 10% discount.

According to Polasik, Piotrowska, Wisniewski, Kotkowski, & Lightfoot (2015), the adoption of Bitcoin has two-sides: simultaneous adoption by both

merchants and consumers. In this research, the merchant side of adoption is mainly focused. Results show that start-up companies have more willingness in adopting bitcoin because they are mostly innovative firms, established in developing countries and used this new payment method for both advertising and gaining access into a new market, which has not been discovered yet. Furthermore, usage of Bitcoin is significantly higher in countries, which has a lower GDP per capita. This makes sense as countries, whose banking system is underdeveloped, tend to provide more chance for developing alternative payment systems. In this research, it is also shown that consumer's level of knowledge about bitcoin influences usage of Bitcoin positively in payments, which means lack of knowledge is one of the main obstacles against adoption. Moreover, most of the people choose using PayPal against Bitcoin among other alternative payment systems which point consumers expect a trustworthy intermediary firm to handle their payment process and solve the problems in case of any dispute such as making a chargeback. Finally, it is discussed that bitcoin user is dispersed, and the usage of Bitcoin can be increased with network effects which pushes the consumer to use new technology because most of the people around them using it (i.e., Facebook).

In the research of Pakrou & Amir (2016), the relationship between perceived value and the intention of using Bitcoin is studied with the help of technology acceptance and the diffusion of innovations models. Total of 23 factors which effect perceived value are determined and grouped into seven groups, which are named as an individual, structural, innovative, cultural, environmental, infrastructure, and political factors. In the conceptual model, a positive relationship is built between perceived value and intention of using Bitcoin. The data is collected via survey and hypothesis are tested using structural equation modeling and the analysis of path. In

the findings of this research, it has been proved that infrastructural, structural, individual, and cultural factors have a positive impact on the user's intention through perceived value. On the contrary, innovative, political, and environmental factors have no significant effect on the user's intention.

In the graduate thesis of Spenkelink (2014), about adoption process of cryptocurrencies, an answer to the question of what are factors influencing the adoption of cryptocurrencies in different usage scenarios for different stakeholders is studied. This research is conducted in Netherland within the context of Diffusion of Innovation Theory. The data is collected by interviews with different stakeholders such as employees of a bank, employees of a cryptocurrency exchange company, employees of a Dutch company that accepts Bitcoin. In this model, the benefits, which are determined as fast transactions, low cost, no single point of failure, good audit trail, irreversible transactions, decentralization, and partial anonymity, are found to have a positive effect on adoption. On the contrary, complications, decentralization, security risks, partial anonymity, cyber-crime, no issuing of credit possible, no backing of the government, and price volatility are counted as disadvantages with effecting adoption negatively. Some external factors, such as media, government policy, and role models, are also considered in the conceptual model. Consequently, all factors seem to be required for successful adoption and it is concluded that if adoption is started on a large scale, it would spread on a global scale due to the network effect. The same prediction has found a voice in the study of Polasik, et al. (2015).

Spenkelink (2014) also stated that, the speed of adoption progress was very slow due to three main pillars, which are ease of use, price stability, and governance against cryptocurrencies. Through governance, Spenkelink (2014) suggests that there

is no roadmap for solving issues in front of cryptocurrencies such as scalability problems when big mining companies enter into the market. While no major problem is noticed on security, if the adoption rate increases at a higher level, then the protection of wallets could become a crucial problem. On the other hand, anonymity is considered as a disadvantage of cryptocurrencies only by banks, while there is agreement that clarity of regulation has a positive impact on adoption.

In the study of Darlington III (2014), mainly the global adoption of Bitcoin is studied. He stated that the countries, which have both unstable monetary policies and have a high rate of corruption are more likely to adopt Bitcoin. In these countries, people find cryptocurrencies safer than local currency. However, the underdevelopment of technological infrastructure hinders large-scale adoption in these countries. Besides that, security breaches in Bitcoin infrastructure cause faith in bitcoin to be shaken. Furthermore, the fear of unknown dominates the people who have no idea about computer science and cryptography.

Another resource about adoption is from Yosupov (2015). In this research, benefits and risks associated with the development and adoption of crypto-currencies are studied with the help of using mind genomics, which is a market research methodology. The advantages of digital currencies appear as a modernized way of payment strategy, providing lower or zero cost, bringing new classes of payment (i.e., Micropayments), lower processing times, allowing the cross-border transaction, providing more security, transparency of transactions as well as anonymity, and easy accessibility from anywhere. On the other hand, regulations, crime risks, price volatility, and lack of user knowledge about security and blockchain technology are specified as disadvantages of cryptocurrencies. On the side of adoption, the interests of cryptocurrency consumers are segmented into three groups. The first group is for

consumers who are most interested in consumer protection and financial privacy. The second group includes consumers who are most interested in practical and cost-beneficial aspects of cryptocurrencies. The last group has consumers who are most interested in ease of use, convenience, and accessibility.

Lastly, in the research of Roussou & Stiakakis (2016), the actual use of cryptocurrencies by EU based companies is studied from aspects of diffusion, acceptance, and adoption supported by Diffusion of Innovations Theory and Technology Acceptance Model. However, experimental results have not been collected yet, to explain actual digital currency use, authors have built research model over three dependent variables, which are perceived usefulness, perceived ease of use, and perceived security. All of the variables have been affected by the characteristics of the decision-making unit, prior conditions, and compatibility.

3.2 Discussion of existing adoption theories

Before continuing to build the theoretical framework, discussion of existing adoption theories can guide us to enrich the model. According to Ute Hillmer, existing theories considering technology adoption are divided into five groups by purpose (Hillmer, 2009). See Fig. 7. In this section, the theories under user acceptance theories are predominately discussed. Besides this, one each theory under diffusion and organization structure theories are also discussed.

Diffusion Theories	User Acceptance Theories	Decision Making Th. (incl. Problem Solving Theories)	Personality Theories	Organisation Structure Theories
Innovation Diffusion Theory IDT also called Diffusion of Innovation Theory DOI (Rogers 1962) Technology Lifecycle Theory (Rogers 1962; Moore1995) **Focus on technology, on the environment and on the using organisation**	Theory of Reasoned Action TRA (Ajzen and Fishbein 1973, 1975) Theory of Planned Behaviour TPB (Ajzen 1991) Technology Acceptance Model TAM 1; TAM 2 (Davis 1989) Motivational Model (Vallerand 1997) User Acceptance of Information Technology UTAUT (Vankatesh et al. 2003) **Focus on the rational employee interest**	Rational Choice Theory/ Game Theory Decision Making under Uncertainty Risk Management Change Management Media Richness Theory (Daft and Lengel 1984) **Focus on the rational organisational/management interest**	Technology Lifecycle Theory (Rogers 1962; Moore 1995) Non-technology related approaches are : Social Cognitive Theories SCT (Compeau and Higgins 1995) **Focus on the individual cognitive interest**	Disruptive Technology Theory (Bower and Christensen 1995) Creative Destruction Theory (Schumpeter 1912, 1942) **Focus on the strategic organisational interest**

Fig. 7 Frequently used technology adoption theories (Hillmer, 2009)

3.2.1 Technology acceptance model (TAM)

TAM is the most-used adoption theory in the past thirty years. The Technology Acceptance Model, which was developed in the late 1980s to explain why people use technology in a work context. See Fig. 8. To understand this theory, looking to the term “work context” and the year when the theory was developed is critical. In these years, people mostly use paper and hand for writing activities at work. The technologies such as personal computers with word processing software made people’s work-life easy. Hence, they found technology easy to use and useful for the work. This theory does not say anything about the technology itself. It focuses on what people believe or what they perceive. In other words, TAM is not cared about if the technology is useful or easy to use; it is interested in perceptions, which may change depending on experience, age, and gender. The perceptions in a specific

technology can be quite different, not because the technology is different but because the people are different (Davis, 1986).

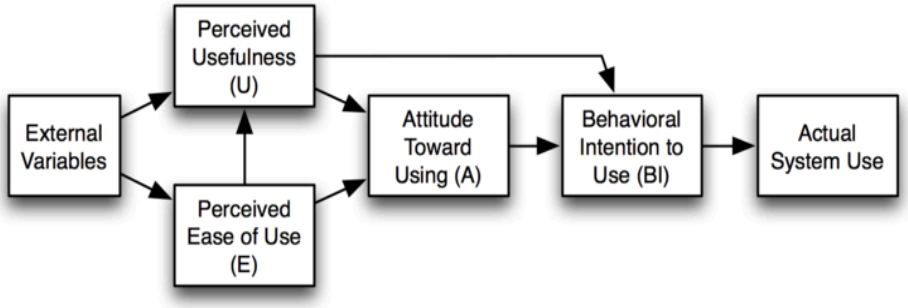

Fig. 8 The technology acceptance model (Davis, Bagozzi, & Warshaw, 1989)

On the other side, there are some restrictions on the technology acceptance model. This model presumes that people have a plan in their behavior, and they are wise in their actions. In other words, it assumes that people evaluate usefulness and ease of use of technology once they develop an intention to use it. However, it is not valid; people are not entirely rational in making a decision and in their actions either. Not every action that people do is backed by planned reason; people have emotions and can be easily directed by psychological effects. However, technology Acceptance Model ignores non-rational decision-making process of people while evaluating the technology (Legris, Ingham, & Collerette, 2003).

Another limitation of TAM is that it does not tell anything about how to make technology useful or easy to use. It means it just tells that you make technology easy to use and useful for the better adoption of people, but it does not give any idea about how new technology should be designed for better adoption. There is no doubt; every technology is designed by considering ease of use and usefulness somehow. However, not all technology is useful and easy to use. It shows that TAM is good at

explaining perceptions but not so good at explaining irrational behaviors and the design of technology for better adoption (Venkatesh & Bala, Technology acceptance model 3 and a research agenda on interventions, 2008).

3.2.2 Diffusion of innovation (DOI)

The term innovation always excites people due to the sensation of change. However, every people have different adoption times while welcoming new technology. Fifty years ago, Everett Rogers found a theory called diffusion of innovation to explain how new ideas spread. Everett Rogers, the author of this theory, separated people into five groups which represent people with different adoption times (Rogers, 1995).

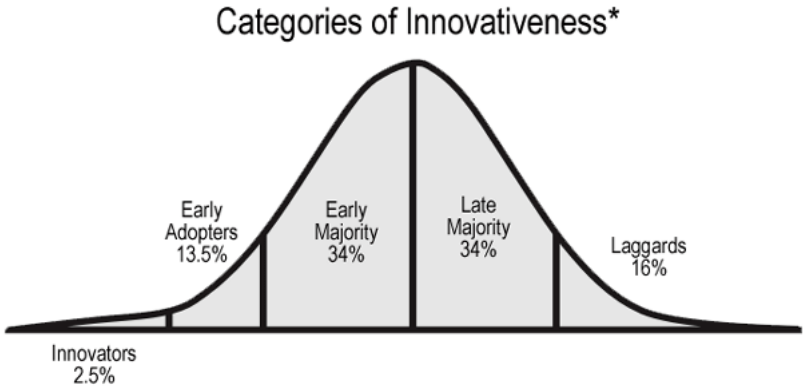

Fig. 9 Five categories of adopters (Rogers, 1995)

The first group called the innovators, who are consist of 2.5% of all pie who are the earliest adopters. The people who sleep outside of Apple stores to buy a new iPhone when it just comes out are precisely in this group. The second group called early adopters, who consist of roughly 13.5% of all people who come immediately after the first wave. At this stage, early adopters have satisfaction while the product is maturing in its abilities. The third group, called the early majority, has people who

represent 34% of all. They usually take action to adopt new technology after the technology widespread and commonly used successfully by previous adopters. The fourth group called late majority, which represents people who are more cautious and usually wait for a reduction of the prices with a size of 34% of all. The last group, called Laggards, represents roughly 16% of all people who are unwilling to adopt new technologies but finally accept it. (Greenhalgh, et al., 2005).

If you connect these five groups of the diffusion of the innovation theory over time, it will form a bell curve sketched in Fig. 9. On the other hand, there are some limitations to this theory as well as other theories. Cultural and economic differences with incomplete information can impede the spreading of innovation (Moore G. A., 2002).

Rogers also created a model called Innovation Diffusion Theory (IDT) to measure the effect of diffusion of innovation on adoption. The model initially was developed with five independent variables, which are relative advantage, complexity, trialability, compatibility, and observability (Rogers, 1995). See Fig. 10.

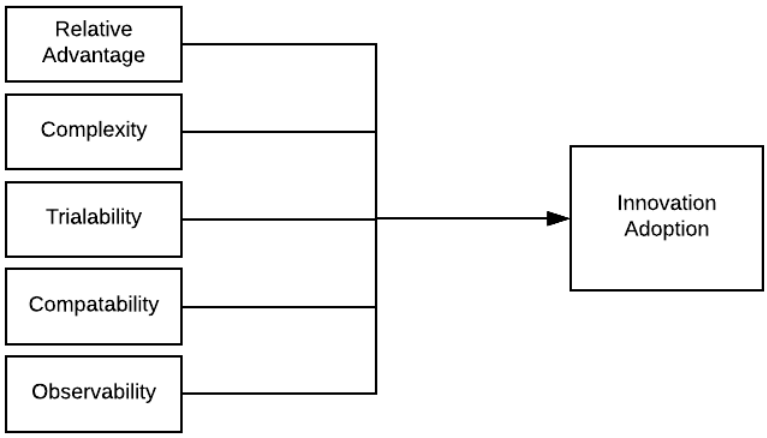

Fig. 10 Innovation diffusion theory (Rogers, 1995)

3.2.3 Theory of planned behavior (TPB)

Icek Ajzen developed the theory of planned behavior in 1985 to explain what exactly influences our decision-making process. This theory consists of several predictors of intentions. See Fig. 11. The first one is behavioral attitudes. At this point, thinks and feels about behavior are in a person's mind as the belief of a particular behavior or act makes a positive or negative impact on that person's life (Ajzen, 1991). In other words, in smartphone example, a person asks that buying a new smartphone makes sense for you or not or which phone makes the most sense for you.

A second predictor is called the subjective norm. This predictor focus supports given by others who are significant, like family and friends. In other words, supports from your social network who encourage the behavior or do the behavior. As an example of a smartphone, advice from your environment about buying an Android smartphone or iPhone influences your decision.

A third predictor is called perceived behavioral control, which is related to the capability and confidence of an individual to overcome barriers and challenges. Again, in the smartphone example, you might go to a store where smartphones are sold and try a few of them. After that, you form an opinion on how easy or hard it is for you to use each one.

When it is considered that the theory as a whole a positive behavioral attitude, favorable encourages from your environment and high level of perceived behavioral control are the best predictors for developing a stronger behavioral intention and more likely to engage in the activity. In other words, it predicts that if you think a specific smartphone is a good idea and you believe everyone else thinks it is a good idea and you believe you can use it then you will buy that phone. If one of those predictors is negative, then you are much less likely to buy that smartphone,

and the likelihood decreases if two or more of these constructs are unsuitable (Armitage & Conner, 2001).

Planned behavior is up to today, one of the best predictors and theories used in marketing. There are many examples in everywhere in the tech world. Information is abundant for us to form our opinions and infomercials everywhere. Ratings & reviews and discussions about every product and service are spread out there, and it is told to us that people who buy what we are about to buy are also buying this other thing. Finally, we are prompted everywhere to test almost every web platform or service out there before we subscribe to see if we can actually handle it and if it makes sense for us. All of this, in combination contributes to us making a decision, and modern marketing needs to master all these avenues to successfully place a service or product to digital natives spending their time on the Internet (Pavlou & Fygenson, 2006).

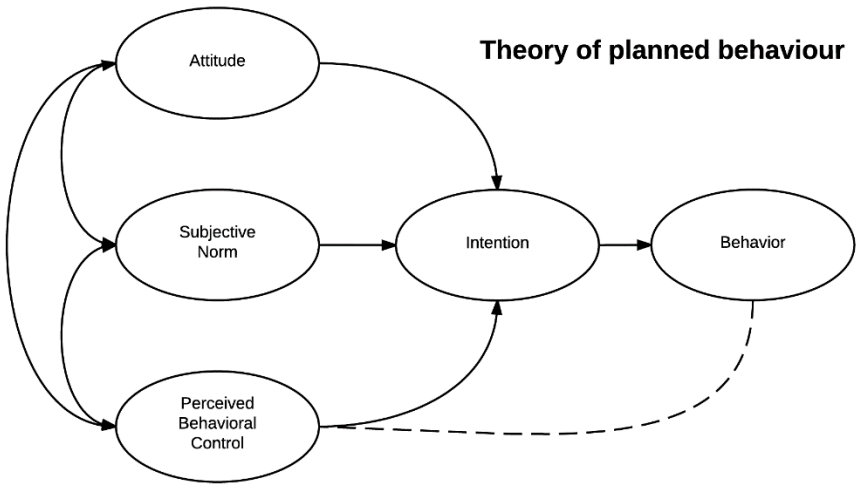

Fig. 11 The theory of planned behavior (Ajzen, 1991)

Today, all of the predictors of planned behavior are used in marketing effectively to spread adoption of products or technologies. As an example, some

companies offer a discount to their customers if they refer them to their friends. Without being noticed, we all are guided by comments and ratings written by other customers who express their feelings on the internet. Moreover, there are attractive stores where trying new products or technologies are offered. Think about Bitcoin; some of these predictors have not been introduced to consumers. For example, trying of payment with bitcoin would be beneficial to form intention on consumers' mind.

3.2.4 Unified theory of acceptance and usage of technology (UTAUT)

Unified theory of acceptance and use of technology was introduced as an aggregation of eight most popular models and theories. These are technology acceptance model, theory of reasoned action, theory of planned behavior, motivational model, a combined version of TPB and TAM, innovation diffusion theory, model of PC utilization, and social cognitive theory (Williams, Rana, & Dwivedi, 2015).

In this model, there are four independent variables, which are named as performance expectancy, effort expectancy, social influence, which influences behavioral intention, and the independent variable facilitating conditions, has impact on use behavior. In addition, behavioral intention has an impact on use behavior. Unlike TAM, this model uses moderating variables of consumer's gender, age, experience, and voluntariness. See Fig. 12

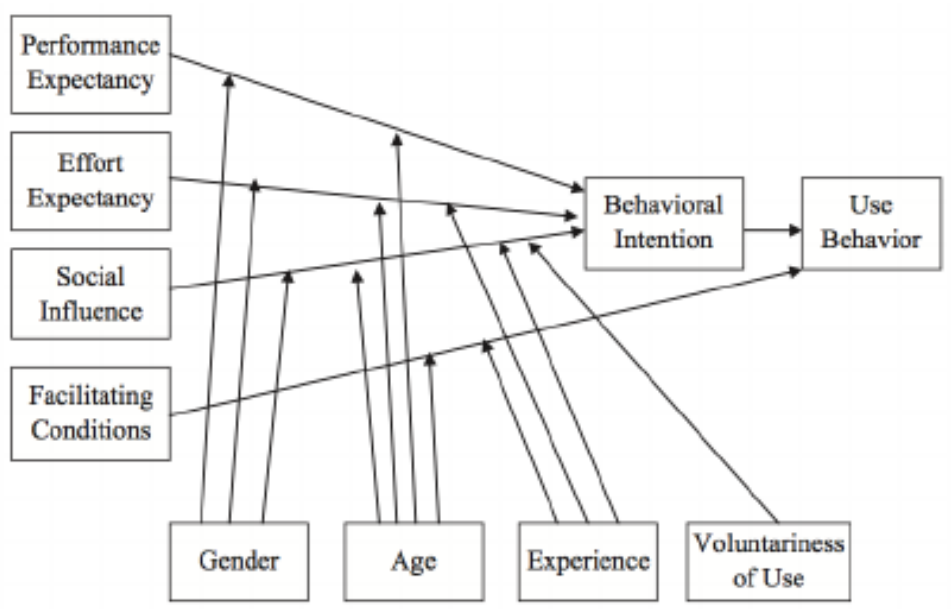

Fig. 12 The framework of UTAUT (Venkatesh, Davis, Morris, & Davis, 2003)

Venkatesh et al. (2003, p. 447) stated performance expectancy as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance". The author measures personal outcome expectation, extrinsic motivation and perceived usefulness with this construct and hypothesizes the moderating effect on the behavioral intention by gender and age. Effort expectancy represents perceived ease of use and complexity. Venkatesh et al. (2003, p. 450) describe this construct as "the degree of ease associated with the use of the system" and moderate it with gender, age, and experience. Through social influence, subjective norm, social influence, and image can be counted. According to Venkatesh et al. (2003, p. 451), this construct is described as "The degree to which an individual perceives that important others believe he or she should use the new system". All moderating variables make hypothesis with this construct. The last independent variable called facilitating conditions which groups perceived behavioral control and facilitating conditions. Only age and experience are used as

moderating variables on this construct which defined as “The degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system” by the Venkatesh et al. (2003, p. 453).

3.2.5 Task-technology fit (TTF)

Task-technology fit is an excellent theory to explain why people use specific technology for particular tasks (Goodhue & Thompson, 1995). To facilitate understanding of this theory, baking a cake would be a good example. To bake a cake, we find a recipe using the internet or cookbook then we mix the ingredients using a mixer after that we put the mixture into a baking tray and cook it in the oven. If we look at the task and technology characteristics, we see that two sets of characteristics are aligned. For baking a cake, we need a scorching environment, and an oven provides a confined hot space. It is a perfect match! However, we could try the frying pan or microwave, but the chances are that your cake turns out much better in the oven so you may use the oven again. The oven also helps us to make a pizza, but for scrambled eggs, it offers an inferior task-technology fit. See the model in Fig. 13.

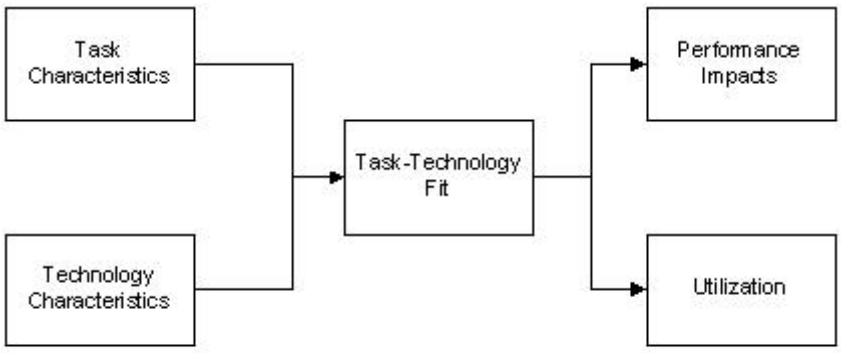

Fig. 13 Task-technology fit model (Goodhue & Thompson, 1995)

On the side of information systems, alignment of tasks and technologies changes very often because people's preferences change very fast with quick technological progress. For example, if you wanted to add effects to a digital photo, a relatively professional digital camera combined with Photoshop would have done the job for you without much of an alternative. Today Instagram do the same thing for you with just the help of a smartphone. However, this is not mean of professional cameras, and Photoshop is gone. Just their task-technology fit was changed.

As a side effect, task-technology fit has become a powerful model for understanding what is behind the dynamism of the tech industry and its non-stop drive to innovate. The tech business produces a technology that fits what we want to do, we come across it, and we use it. We perform better to the task than before and therefore, use it more often (Maruping & Agarwal, 2005).

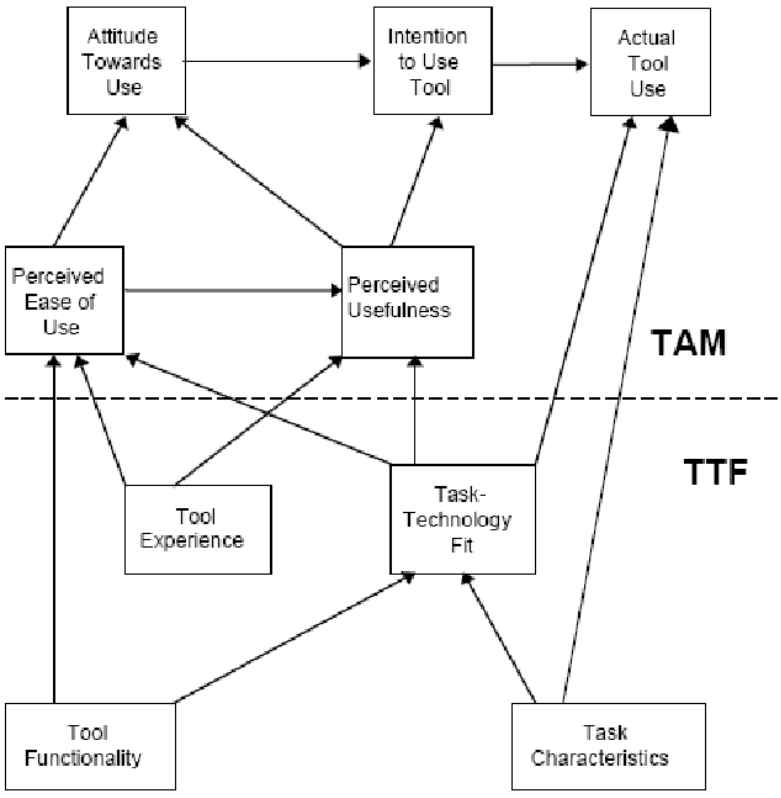

Fig. 14 Combining TTF with TAM (Dishaw & Strong, 1999)

Task-technology fit has been combined with other theories to extend its power to explain and predict. For instance, tasks technology field has been combined with the technology acceptance model. See Fig. 14; the combined model is used to predict that if a technology's functionality can help you to achieve a task and you perceive this technology as being easy to use. You will find the technology more useful, and you are more likely to use it (Dishaw & Strong, 1999).

3.2.6 Disruptive innovation (DI)

In 1997, a theory of disruptive technology (See Fig. 15) was put forward by Professor Clayton Christensen from the Harvard Business School to explain how disruptive technologies cause market leaders to fail even when they seem to do everything right (Christensen, 1997). As an example, the photo company Kodak would be given. They still did not survive because digital photo technologies disrupt their business. What is more interesting is that when this was happening, they were thinking of everything was right.

The performance of a product in the market is improved continuously to make it useful for customers. However, the satisfaction level of customers from a product is different from one customer to the next. Some customers can be satisfied with very basic levels of performance, such as taking a photo with a basic model of photo machine. Besides, some customers are very demanding and can only feel satisfied with very high levels of performance from technology, such as professional photo machines. When disruptive technologies enter the market the first time, they offer deficient performance. Remember the first smartphones with a camera, which offer a meager resolution. However, their performance steadily improves. So, in the early days of disruptive technology, the innovation is considered to be not good

enough by most of the market. However, it seems entirely accepted by customers who can be satisfied with the deficient performance. The attention of this small group of customers might be excited by the fact that this barely right enough technology is less expensive or offers them a bit of new functionality that the old technology did not provide (Danneels, 2004). In Kodak case, smartphones with the camera provide to take pictures and see them on the phone screen in reasonable price even the resolution is worse than analog photo machines. How couldn't big companies see this innovation will disrupt their business in the near feature? The main problem is that the big companies assess new technologies by asking questions of their biggest customers who are satisfied with the very high level of performance.

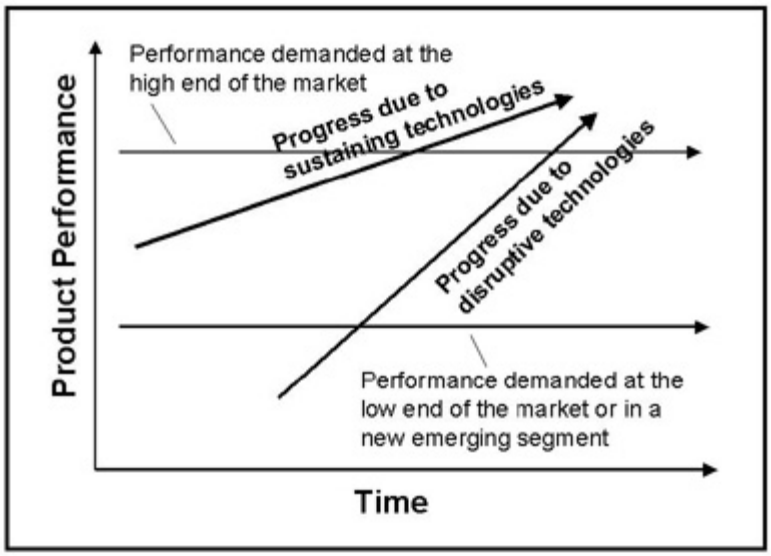

Fig. 15 Disruptive vs. sustaining technologies (Christensen, 1997)

They reply that this new technology does not meet their needs. So that very rationally, big companies do not take any action against new technology, and they continue to focus on existing technology which they already have. However, there is a little thing which is ignored by companies is that performance improvement

progress of disruptive technologies are faster than existing technologies. Therefore, disruptive technology meets the requirements of customers who are satisfied with the very high level of customers in a short time. By this time, it is usually too late for the companies to do much about it because they fail to develop the required capabilities to cope with new disruptive technology (Gilbert, 2003). In the case of Kodak, they failed due to being late to take action before smartphones have the capability of taking pictures as high resolution as photo machines.

Now think about technologies, which have the potential to disrupt an existing business. For now, cryptocurrencies, like Bitcoin provides a deficient level of performance. Their payment functionalities are not used widely, but some consumers who do not feel afraid of using this new technology already started to embrace Bitcoin. On the other hand, big payment companies such as Master Card and Visa do not take any concrete action to enable their infrastructure for payment with Bitcoin. This trajectory shows us if big payment companies continue to stick with their existing technology, the end of them may resemble Kodak shortly.

3.3 Theoretical model and hypothesis development

The subjects that were discussed as the effect on consumer adoption of Bitcoin in the previous studies are shown as a mind map in Fig. 16. In this section, a research model with its hypotheses are proposed to measure the factors, which affect cryptocurrency adoption in terms of using in e-commerce.

3.3.1 Theoretical framework

A research model addresses the primary motivation of this research, which is to measure consumer adoption of using bitcoin in e-commerce. According to the

leading bitcoin news website 99bitcoins.com, there are only 90 companies, which accepts bitcoin as payment in the world (Chokun, 2018). Besides that, not all of them run their business through e-commerce. There are companies who run the business only in the offline market providing pay with bitcoin solution in addition to physical payment. Therefore, in comparison with the most dominant payment methods such as cash and credit card, it is distinguishable that the usage rate of bitcoin as payment is extremely low.

From the diffusion of innovation perspective, today, consumers of bitcoin are yet in the "early adopters" stage (Wolfson, 2015). Therefore, measuring consumer adoption would be quite tricky if complex models will be used. It is mentioned that UTAUT has become complex by introducing many constructs (Wu, 2009). With so many constructs, it has become a highly complex model and overcomplicated for analyzing the adoption of consumers who stay at the early adopters' stage. On the other hand, TAM is more focused on information systems in the work context and far away from capturing the essence of bitcoin well.

Diffusion of innovation theory seems well-applicable model into this scenario. Moore & Benbasat (1991) extended Roger's original IDT model by extracting the factors result demonstrability and visibility from observability, extending complexity with ease of use, and introducing the constructs image and perceived voluntariness in order to adapt the model for the adoption of IT innovations in particular. See Fig. 17.

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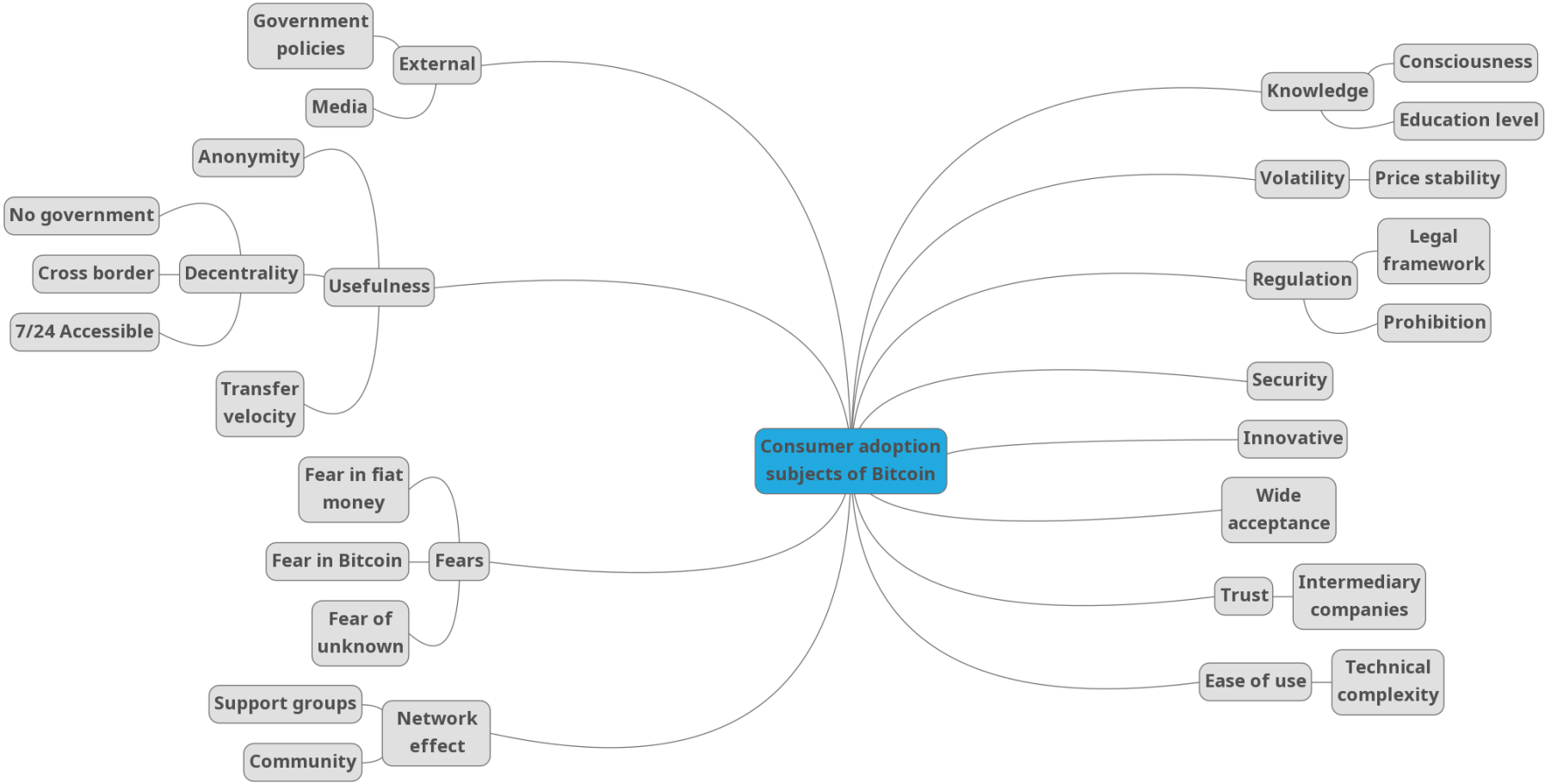

Fig. 16 Consumer adoption subjects of Bitcoin

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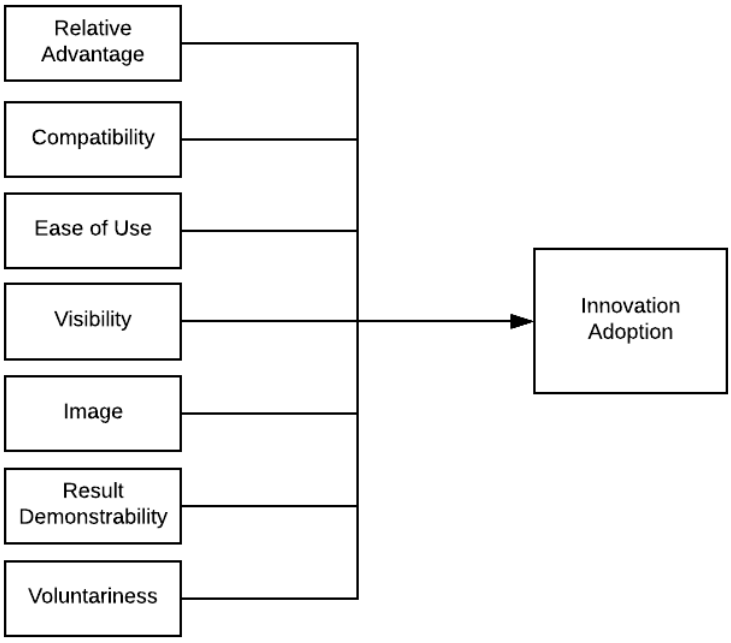

Fig. 17 Innovation diffusion theory adaptation (Moore & Benbasat, 1991)

In the second phase, the model was enriched to measure some risks in the adoption process. To realize this, the research of Ryu (2018) guided our research. In this research, the author studied fintech continuance intention by looking at the effect of financial and legal risks. So, our model was enriched by introducing these constructs. Lastly, compatibility from Moore & Benbasat's (1991) research was used

to measure compatibility of cryptocurrency payment with current methods which people are used to. In the end, our theoretical model is shown in Fig. 18.

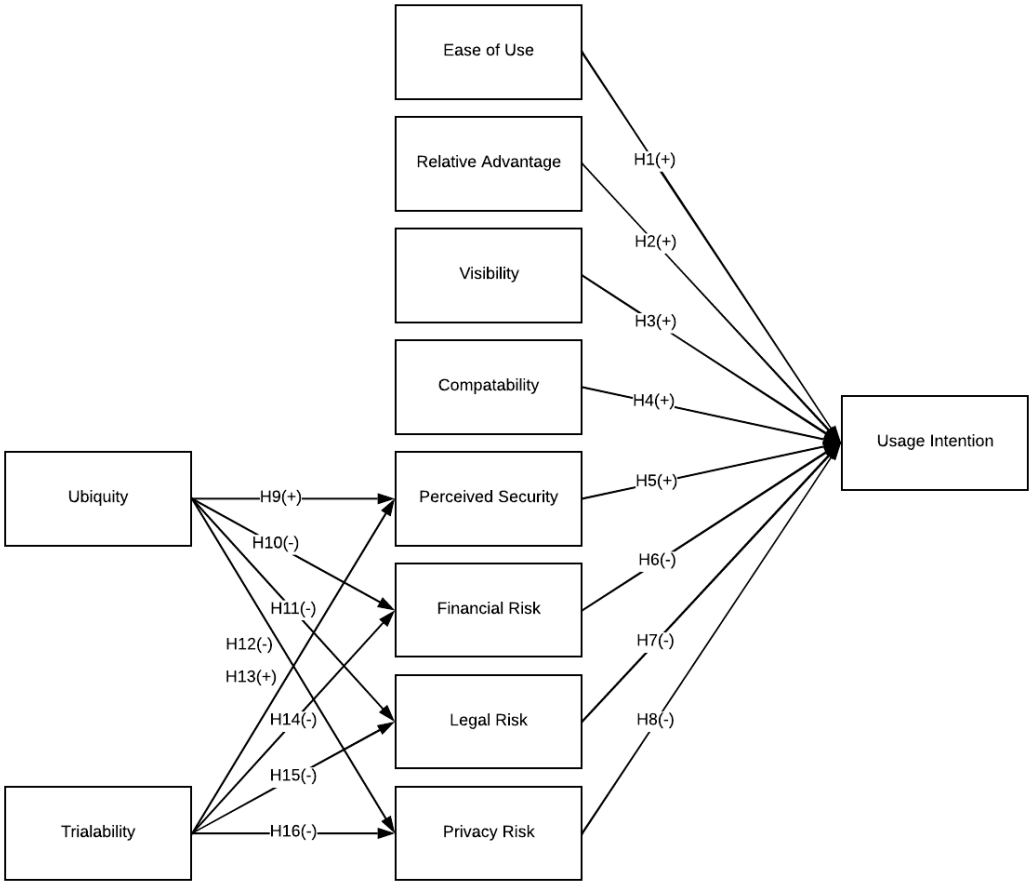

Fig. 18 Theoretical framework

3.3.2 Research question and related hypotheses

As explained in the introduction part, there were two research questions in this thesis. First, one is about examining research fields, which were studied so far about bitcoin and how these topics are changed over time. It was studied in the previous chapter by content analysis research methodology.

The second and the main research question was about understanding the factors, which lead the consumer to the adoption of bitcoin in e-commerce. So, the research question was proposed as

RQ_2: “What are the factors which affect consumer adoption of bitcoin in e-commerce?”

Below measures are used to explain the research question in the theoretical framework with their hypotheses.

3.3.2.1 Ease of use

It is described as “the degree to which an individual believes that using a particular system would be free of physical and mental effort” by Moore & Benbasat (1991, p. 197). This construct has been investigated in many technology adoption studies such as mobile wallet adoption (Shin, 2009), mobile payment adoption (Zhou, The effect of initial trust on user adoption of mobile payment, 2011), and cryptocurrency adoption (Roussou & Stiakakis, 2016). Payment in e-commerce is the real conversion killer step in checkout funnel, so using cryptocurrencies in e-commerce should not require a technical challenge to use. Hence, the following hypothesis is proposed:

H1. Ease of use positively influences the intention of consumers to use cryptocurrency in e-commerce.

3.3.2.2 Relative advantage

It is described as “the degree to which an innovation is perceived as being better than its precursor” by Moore & Benbasat (1991, p. 195). This construct has been found widely in related studies like e-commerce adoption (Poorangi, Khin, Nikoonejad, & Kardevani, 2013), and mobile payment adoption (Mallat, 2007). If cryptocurrencies are considered using in e-commerce, then it should be better than other payment

methods such as credit card and cash on delivery. Hence, the following hypothesis is proposed:

H2. Relative advantage positively influences the intention of consumers to use cryptocurrency in e-commerce.

3.3.2.3 Visibility

It is described as "the idea of the innovation being visible" by Moore & Benbasat (1991, p. 203). Visibility has been used in a variety of technology adoption areas (Hsu, Lu, & Hsu, 2007) (Agarwal & Prasad, 1997) (Johnson, Kiser, Washington, & Torres, 2017). People adopt new technologies faster if they see more people using it. Hence, the following hypothesis is proposed:

H3. Visibility positively influences the intention of consumers to use cryptocurrency in e-commerce.

3.3.2.4 Compatibility

It is described as "the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters" by Moore & Benbasat (1991, p. 195). Previous studies say that compatibility has an impact on e-commerce adoption for non-internet shoppers (Faqih, 2016). This measure was selected to understand the effect of compatibility on cryptocurrency payment in e-commerce. Hence, the following hypothesis is proposed:

H4. Compatibility positively influences the intention of consumers to use cryptocurrency in e-commerce.

3.3.2.5 Perceived security

It is described as the perception of the innovation is risk-free by Shin (2010). In previous researches, it is revealed that there is a positive relationship between security and usage intention (Schierz, Schilke, & Wirtz, 2010). It is valid in our research context, as well. As people give money before getting the goods in e-commerce, they need to feel secure while making payment. Hence, the following hypothesis is proposed:

H5. Perceived security positively influences the intention of consumers to use cryptocurrency in e-commerce.

3.3.2.6 Financial risk

In a prior study about online shopping adoption, the financial risk is described as the potential net loss of money in financial transactions (Forsythe, Liu, Shannon, & Gardner, 2006, p. 57). A strong relationship is found in previous studies between financial risk and online user behavior (Abramova & Böhme, 2016) (Benlian & Hess, 2011) (Liu, Brock, Shi, Chu, & Tseng, 2013). Cryptocurrencies are incredibly volatile. Consumers may think that they will lose money if they prefer using cryptocurrency instead of keeping it in their pocket. Moreover, there is no intermediary responsible for cryptocurrency transactions, so consumers may be afraid about who will be responsible if there will be a problem during payment. Hence, the following hypothesis is proposed:

H6. Financial risk negatively influences the intention of consumers to use cryptocurrency in e-commerce.

3.3.2.7 Legal risk

In a study about Fintech continuance adoption, legal risk is described as unclear legal status and the lack of universal regulations (Ryu, 2018). It is certainly valid for the cryptocurrency world. Cryptocurrencies are not regulated by either domestic or international law (Turpin, 2014). There is no court of justice if someone steals consumers' money from their wallet. Hence, the following hypothesis is proposed:

H7. Legal risk negatively influences the intention of consumers to use cryptocurrency in e-commerce.

3.3.2.8 Privacy risk

It is described as "the concern an individual would have regarding the potential compromise of their personal information" by Johnson et al. (2017, p. 115). According to previous studies, people think that using mobile payment services put their individual information at risk (Dewan & Chen, 2005). Payment with bitcoin is a similar to mobile payment, hence the following hypothesis is proposed:

H8. Privacy risk negatively influences the intention of consumers to use cryptocurrency in e-commerce.

3.3.2.9 Ubiquity

In a study about mobile payment services, ubiquity is defined as the "user having access to m-payment services at anytime and anyplace" by Johnson et al. (2017, p. 115). Obviously, one of the critical features of cryptocurrencies is ubiquity too, as they are available to use at any time and anyplace.

Cryptocurrencies are not based on any government-related policies unlike other currencies, and they are accessible at any time and any place via Blockchain

technology. Moreover, the relationship between perceived security and ubiquity was already discovered in prior studies (Zhou, 2011). Hence, the following hypotheses are proposed:

H9. Ubiquity positively influences perceived security.

H10. Ubiquity negatively influences financial risk.

H11. Ubiquity negatively influences legal risk.

H12. Ubiquity negatively influences privacy risk.

3.3.2.10 Trialability

It is described as "the degree to which an innovation may be experimented with before adoption." by Moore & Benbasat (1991, p. 195). In a study by Arvidsson (2014), it is suggested that adoption is a learning process. More learning about the innovation can trigger feeling more comfortable and finally it leads to adoption more likely. People always have fears to approach innovations that will use. In addition to that, because bitcoin is not real money, people have more hesitation in using it. People need to feel secure before using new technologies, primarily for payments. Hence, the following hypothesis is proposed:

H13. Trialability positively influences perceived security.

H14. Trialability negatively influences financial risk.

H15. Trialability negatively influences legal risk.

H16. Trialability negatively influences privacy risk.

3.3.2.11 Usage intention

In previous studies, this variable is used for measuring consumer adoption to new technology (Johnson, Kiser, Washington, & Torres, 2017). In this context, our

dependent variable is described as the individual's intention to use cryptocurrency in e-commerce.

3.4 Research methodology

In this section, data collection method with convenience sampling is discussed following the development of the questionnaire. Moreover, items of each construct are presented with descriptive statistics throughout this section.

3.4.1 Data collection method

The data was collected using a survey, which was created via Google's online questionnaire tool called google forms. The survey was conducted during the three-week period in March-April 2019. The survey link (URL) was shared with relatives, colleagues, friends, and they were requested to share the survey with their friends. In addition, the survey was shared over social media channels such as Facebook and LinkedIn too. Finally, 209 answers were collected from participants.

3.4.2 Questionnaire development

The survey was developed by adapting scales from previously validated studies (Moore & Benbasat, 1991) (Johnson, Kiser, Washington, & Torres, 2017) (Ryu, 2018). For more details about scale references, see APPENDIX A for English or APPENDIX B for Turkish. For all non-demographic questions on the survey, the five-point Likert scale was used to measure independent variables, while one represents strong disagreement and five represents strong agreement. After the initial questionnaire was developed, the advisor and a lecturer were asked to review. Then,

some questions were modified little in order to provide a better understanding while translating items from English to Turkish.

3.4.3 Constructs

Each construct was derived from previously validated studies, and they are referenced with their questions in APPENDIX A and APPENDIX B (Turkish). Descriptive statistics of each construct is shown in Table 8. In the beginning, there were 209 respondents, however as one questionnaire was incomplete it was removed. Eventually a total of 208 answers were used for further analysis. Initial analysis show that ease of use and relative advantage scores are around 3 suggesting that the knowledge of the respondents on bitcoin usage in e-commerce is limited. Visibility score is around two implying the low visibility of bitcoin usage in e-commerce. Similar results are found for ubiquity. The average scores for the perceived risk, security and financial and legal risk respondents are also around three suggesting that the respondents neither agree nor disagree with the risks of the bitcoin.

3.5 Analysis and findings

In this section, the survey answers are analyzed with SPSS and SmartPLS data analysis tools. Frequencies, crosstabs, reliability, factor, partial least square, and bootstrapping analyses are conducted in order to investigate the research question and to test hypotheses, which are proposed in previous sections. The results of the analyses were presented with interpretations to provide further information throughout this section.

Table 8. Descriptive Statistics of Constructs

Scale (N=208)	Mean	Std. Deviation
EoU1	3.21	1.148
EoU2	3.51	1.171
EoU3	3.89	0.994
EoU4	3.05	1.109
RA1	3.40	1.077
RA2	3.33	1.134
RA3	3.03	1.051
RA4	2.97	1.047
RA5	3.10	1.024
VIS1	2.01	1.108
VIS2	2.55	1.006
VIS3	1.88	0.980
PS1	3.10	1.118
PS2	3.44	1.034
PS3	3.40	1.081
PS4	3.45	1.080
PR1	3.10	1.099
PR2	3.17	1.123
PR3	3.50	1.163
UBQ1	2.79	1.181
UBQ2	2.75	1.198
UBQ3	3.16	1.163
UBQ4	1.89	0.959
UBQ5	2.01	0.968
TRI1	3.88	1.105
TRI2	2.73	1.253
TRI3	3.65	1.084
TRI4	3.07	0.995
FR1	2.91	1.069
FR2	2.91	1.082
FR3	2.72	1.104
LR1	3.66	1.055
LR2	3.51	1.045
LR3	3.66	1.019
COM1	2.89	0.994
COM2	2.97	1.069
COM3	3.01	1.083
UI1	3.00	1.106
UI2	3.02	1.072
UI3	2.94	1.062
UI4	2.84	1.107

3.5.1 Demographics

The demographic information related to survey participants is shown in Table 9. The majority group is male, with 70.7% of all respondents. 77.4% of all participants are between 24 and 35 years old with a higher education background, 92.3% of all participants hold at least a university degree.

Majority of all participants (80.3%) do shopping at an e-commerce channel for more than three years. Therefore, they have enough experience to evaluate payment options in e-commerce. However, 48.5% of respondents, which is nearly half of the participants, have no experience with cryptocurrencies. 51.5% of all participants is familiar with cryptocurrencies.

In order to investigate the relationship between demographic variables and the dependent variable, a crosstab analysis was conducted. A significant relationship between cryptocurrency usage years and cryptocurrency usage intention in e-commerce was found. The cryptocurrency experience variable is re-coded as "experienced" with cryptocurrency experience greater than a year and "inexperienced", who have no experience. For Likert based usage intention questions the answers one (Strongly disagree) and two (Disagree) were grouped as "Disagree" the answers four (Agree) and five (Strongly agree) were grouped as "Agree". So, the findings are shown in Table 10. The people who have cryptocurrency experience are more likely to agree using cryptocurrency in e-commerce with Pearson Chi-Square significance value of 0.004 shown in Table 11.

3.5.2 Measurement model

The model was assessed to determine the validity and reliability of constructs in this section. A confirmatory factor analysis was conducted with all variables, and it is

seen that the scale items UBQ4, UBQ5, FR3 and TRI2 have factor loading value, which is lower than 0.7, so they were removed from the model. The other problem was that there was a collinearity issue in the scale items UI1 and UI2 with a VIF value, which were higher than five. Therefore, they were also removed in order to solve the issue. After removing scale items PLS factor analysis was re-conducted and the results are shown in Table 12.

Table 9. Demographics

Demographic variable	Category	Frequency	Percent
Gender	Male	147	70.7%
	Female	61	29.3%
Age	<18	1	0.5%
	18 - 23	23	11%
	24 - 29	93	44.7%
	30 - 35	68	32.7%
	36 - 41	21	10.1%
	42 - 50	2	1%
	51-60	0	0%
	>60	0	0%
Education	Primary / Secondary school	1	0.5%
	High school	15	7.2%
	Associate / Bachelor	144	69.2%
	Master / PhD	48	23.1%
E-Commerce usage	Never	16	7.7%
	Less than one year	8	3.8%
	Between one and three years	17	8.2%
	More than three years	167	80.3%
Cryptocurrency usage	Never	101	48.5%
	Less than one year	39	18.8%
	Between one and three years	62	29.8%
	More than three years	6	2.9%

The scale has satisfactory internal reliability as all Cronbach alphas are higher than 0.74. Moreover, there is also satisfactory internal consistency as all composite

reliability values are higher than 0.85. In addition, the model has good convergent validity as all AVE values are higher than 0.66.

Table 10. Crosstabulation of Usage and Intention

			Cryptocurrency usage intention in e-commerce			
			Disagree	Indecisive	Agree	Total
Cryptocurrency Usage	Not Use	Count	33	44	24	101
		Expected Count	28.6	36.9	35.4	101
		% of Total	15.9%	21.2%	11.5%	48,6%
	Use	Count	26	32	49	107
		Expected Count	30.4	39.1	37.6	107
		% of Total	12.5%	15.4%	23.6%	51,4%
Total		Count	59	76	73	208
		Expected Count	59.0	76.0	73.0	208
		% of Total	28.4%	36.5%	35.1%	100.0%

Table 11. Chi-Square Test of Crosstabulation

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.123	2	0.004
Likelihood Ratio	11.299	2	0.004
N of Valid Cases	208		

Moreover, the model has good discriminant validity as all factor loadings are higher than 0.7. Besides, the Fornell-Larcker criterion was satisfied as for each latent variable, the square root of AVE values was higher than other variables in a diagonal way, which indicates excellent discriminant validity as well. According to the research of Henseler et al. (2015), Heterotrait-Monotrait Ratio (HTMT) of

correlations can be used to assess discriminant validity. In Table 13 only HTMT(UI,COM) violates $HTMT_{.85}$ criterion. Hence, $HTMT_{.90}$ criterion was satisfied for the model.

3.5.3 Common method bias

Harman's one-factor test was conducted to check if there is a common method bias. If common method bias is present, then either a single factor emerges from the analysis, or one general factor holds the majority of the variance among all variables. All scale items were put into exploratory factor analysis with Varimax rotation in SPSS. The results say that the sampling is adequate with 0.89 Kaiser-Meyer-Olkin value and is significant with the value, which is lower than 0.001. The items explain 77.96% of total variance with ten factors. The first factor explains 35.43% of the variance. So according to Harman's one-factor test, there is no common method bias.

3.5.4 Structural assessment

After proofing the validity and reliability of the measurement model, the structural model is evaluated with PLS path and bootstrapping analysis. Overview of structural assessment is shown in Fig. 19 with R^2 values, significance levels of paths and path coefficients.

3.5.5 Hypothesis testing

Table 14 summarizes that five of 16 hypotheses are supported. The hypotheses H1, H3, H6, H7, H8, H10, H11, and H12 are not supported because they are not significant. The hypothesis H14, H15 and H16 are also not supported because a positive association is found whereas a negative was expected.

Table 12. Validity, Reliability, and Consistency Summary of the Model

Scale Item	Std. Loading	Cronbach Alpha	AVE	Composite Reliability	Factor Correlations										
					EoU	RA	VIS	PS	PR	UBQ	TRI	FR	LR	COM	UI
EoU 1	0.86														
EoU 2	0.90	0.83	0.66	0.89	0.81										
EoU 3	0.75														
EoU 4	0.73														
RA 1	0.89														
RA 2	0.86														
RA 3	0.89	0.91	0.73	0.93	0.73	0.86									
RA 4	0.77														
RA 5	0.86														
VIS 1	0.90														
VIS 2	0.80	0.81	0.72	0.89	0.34	0.37	0.85								
VIS 3	0.85														
PS 1	0.83														
PS 2	0.92	0.88	0.74	0.92	0.52	0.61	0.18	0.86							
PS 3	0.82														
PS 4	0.87														
PR 1	0.78														
PR 2	0.78	0.77	0.68	0.86	0.05	0.10	-0.04	0.02	0.82						
PR 3	0.90														
UBQ 1	0.92														
UBQ 2	0.89	0.89	0.82	0.93	0.54	0.60	0.44	0.48	0.04	0.90					
UBQ 3	0.90														
TRI 1	0.78														
TRI 3	0.86	0.74	0.66	0.85	0.65	0.65	0.23	0.61	0.29	0.55	0.81				
TRI 4	0.79														
FR 1	0.89	0.81	0.83	0.91	0.20	0.12	0.10	-0.09	0.43	0.20	0.25	0.91			
FR 2	0.94														
LR 1	0.94														
LR 2	0.87	0.90	0.83	0.94	0.26	0.23	-0.04	0.23	0.48	0.14	0.38	0.41	0.91		
LR 3	0.93														
COM 1	0.89														
COM 2	0.94	0.90	0.84	0.94	0.68	0.66	0.45	0.56	-0.04	0.62	0.62	0.10	0.18	0.92	
COM 3	0.92														
UI 3	0.95	0.89	0.90	0.95	0.68	0.73	0.44	0.57	-0.02	0.63	0.61	0.14	0.16	0.79	0.95
UI 4	0.95														

Table 13. Heterotrait-Monotrait Ratio (HTMT) Results

	COM	EoU	FR	LR	PS	PR	RA	TRI	UBQ	UI	VIS
COM											
EoU	0.79										
FR	0.11	0.23									
LR	0.19	0.30	0.48								
PS	0.62	0.61	0.11	0.26							
PR	0.10	0.09	0.54	0.57	0.19						
RA	0.73	0.83	0.13	0.25	0.68	0.13					
TRI	0.73	0.82	0.31	0.45	0.75	0.39	0.78				
UBQ	0.68	0.63	0.22	0.14	0.53	0.11	0.66	0.66			
UI	0.88	0.79	0.16	0.17	0.63	0.08	0.81	0.73	0.70		
VIS	0.52	0.42	0.13	0.09	0.20	0.10	0.43	0.29	0.51	0.51	

3.5.6 POST-HOC analysis

After interpreting the results, a possible direct relationship between independent variables ubiquity and trialability, and dependent variable usage intention were tested. An indirect path analysis between them was carried out, and Table 15 shows that there is no significant relationship between them.

Since all risk related constructs have no significant relationship with usage intention, it was decided to look at the group differences of cryptocurrency experience. For this purpose, the participants who answered never to cryptocurrency usage question were grouped into a sample called inexperienced.

The other group consisted of the participants who answered at least one-year experience with cryptocurrencies. After grouping samples, an independent sample t-test analysis was done, and the results are shared in Table 16.

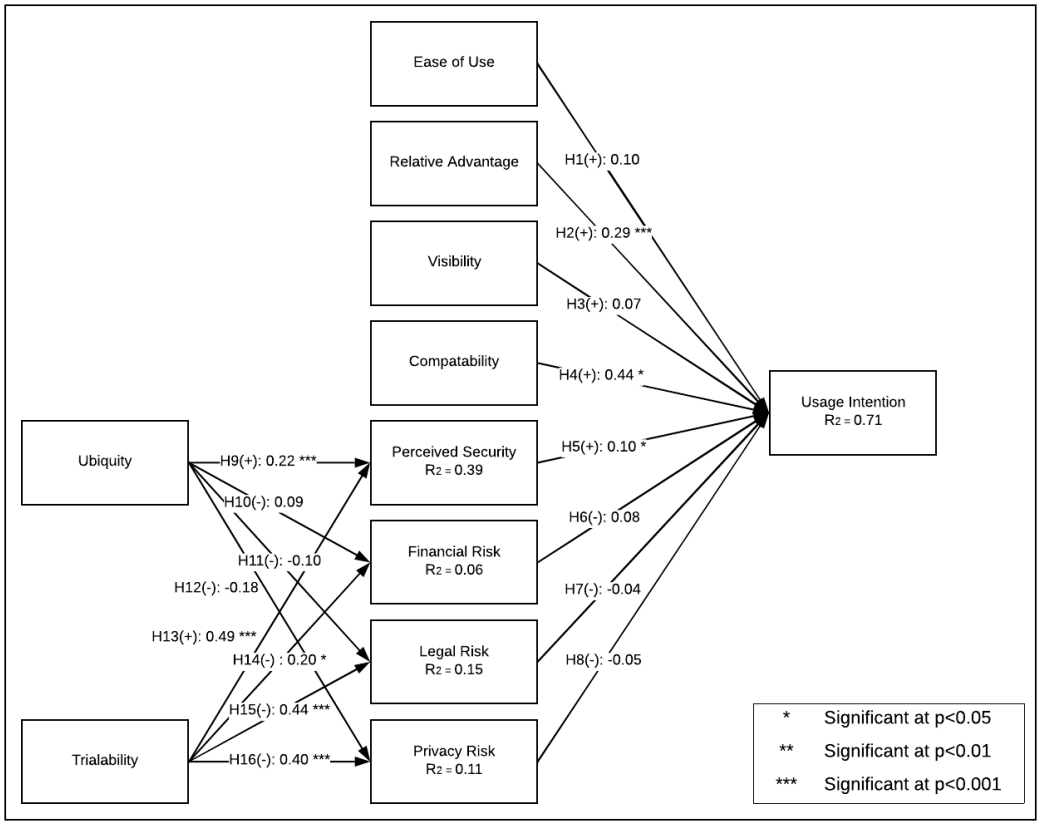

Fig. 19 Structural model

Table 14. Hypothesis Summary

Hypothesis			Path Coefficient	P-value
H1	Ease of use positively influences usage intention.	Not supported	0.10	0.07
H2	Relative advantage positively influences usage intention.	Supported	0.29	0.00
H3	Visibility positively influences usage intention.	Not supported	0.07	0.11
H4	Compatibility positively influences usage intention.	Supported	0.44	0.00
H5	Perceived security positively influences usage intention.	Supported	0.10	0.04
H6	Financial risk negatively influences usage intention.	Not supported	0.08	0.07
H7	Legal risk negatively influences usage intention.	Not supported	-0.04	0.40
H8	Privacy risk negatively influences usage intention.	Not supported	-0.05	0.32
H9	Ubiquity positively influences perceived security.	Supported	0.22	0.00
H10	Ubiquity negatively influences financial risk.	Not supported	0.09	0.39
H11	Ubiquity negatively influences legal risk.	Not supported	-0.10	0.24
H12	Ubiquity negatively influences privacy risk.	Not supported	-0.18	0.09
H13	Trialability positively influences perceived security.	Supported	0.49	0.00
H14	Trialability negatively influences financial risk.	Not supported	0.20	0.04
H15	Trialability negatively influences legal risk.	Not supported	0.44	0.00
H16	Trialability negatively influences privacy risk.	Not supported	0.40	0.00

Table 15. Indirect Effect Analysis

Path	Path Coefficient	P-value	Result
Ubiquity -> Usage Intention	0.041	0.62	Not Significant
Trialability -> Usage Intention	0.027	0.37	Not Significant

Table 16. T-Test between Two Groups

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Usage Intention	Equal variances assumed	3.859	0.051	-3.334	206	0.001	-0.46003	0.13796	-0.73203	-0.18802
	Equal variances not assumed			-3.351	203.354	0.001	-0.46003	0.13728	-0.73070	-0.18935

Levene's test is satisfied as 0.051 > 0.05, which indicates that the variances are distributed homogeneously. The significance value is lower than 0.05, so there is a significant difference between the group, which has cryptocurrency experience and the group which has no cryptocurrency experience.

After finding the difference between the two groups, the whole analysis process was re-run for two sub-groups. In the end, the results showed that the relationship between ubiquity and perceived security (H9) was significant for the group, which has cryptocurrency experience, but it was not significant for the group, which has no cryptocurrency experience. (See Table 17 for details). The findings about the other hypotheses remained the same.

In addition, for exploring the effect of ubiquity to visibility, ubiquity was connected to visibility and whole model was re-analyzed. The results showed that a significant positive relationship was found between them expectedly.

Table 17. Hypothesis Summary for Group Difference

		Inexperienced group			Experienced group		
Hypothesis			Path Coefficient	P-value		Path Coefficient	P-value
H1	Ease of use positively influences usage intention.	Not supported	0.155	0.104	Not supported	0.094	0.222
H2	Relative advantage positively influences usage intention.	Supported	0.385	0.000	Supported	0.191	0.049
H3	Visibility positively influences usage intention.	Not supported	0.033	0.585	Not supported	0.089	0.146
H4	Compatibility positively influences usage intention.	Supported	0.285	0.008	Supported	0.533	0.000
H5	Perceived security positively influences usage intention.	Not supported	0.098	0.235	Not supported	0.112	0.090
H6	Financial risk negatively influences usage intention.	Not supported	0.143	0.113	Not supported	0.027	0.589
H7	Legal risk negatively influences usage intention.	Not supported	-0.160	0.070	Not supported	0.007	0.895
H8	Privacy risk negatively influences usage intention.	Not supported	-0.060	0.529	Not supported	-0.036	0.585
H9	Ubiquity positively influences perceived security.	Not supported	0.192	0.095	Supported	0.212	0.025
H10	Ubiquity negatively influences financial risk.	Not supported	0.001	0.996	Not supported	0.162	0.224
H11	Ubiquity negatively influences legal risk.	Not supported	-0.114	0.356	Not supported	-0.136	0.187
H12	Ubiquity negatively influences privacy risk.	Not supported	-0.121	0.429	Not supported	-0.181	0.223
H13	Trialability positively influences perceived security.	Supported	0.464	0.000	Supported	0.503	0.000
H14	Trialability negatively influences financial risk.	Not supported	0.283	0.051	Not supported	0.147	0.277
H15	Trialability negatively influences legal risk.	Not supported	0.358	0.014	Not supported	0.518	0.000
H16	Trialability negatively influences privacy risk.	Not supported	0.401	0.005	Not supported	0.407	0.004

3.6 Discussions and conclusion

In this study, two main research questions were studied. The research trends on bitcoin and the determinants of consumer adoption of bitcoin in e-commerce. The first part of the thesis answered the first research question with a content analysis. In the second part of the thesis, first a literature review was made particularly on studies that explored the determinant of bitcoin adoption. Following the literature review IDT model is chosen and extended with constructs from Johnson et al. (2017) and Ryu (2018). To our knowledge, this research is the first to examine cryptocurrency adoption in e-commerce.

A survey was developed to test hypotheses whose items derived mainly from previous studies and modified according to our research question. Moreover, demographic questions were added to the survey to see the demographic profile of respondents. The data is collected with convenience sampling method and PLS SEM estimation is made. The large part of respondents was male and had e-commerce experience for more than three years, while more than half of participants had cryptocurrency experience.

3.6.1 Theoretical implications

The structural model was measured with factor and reliability analysis. It was seen that the model has good discriminant validity. Moreover, reliability analysis showed that the model has internal reliability and convergent validity.

The structural assessment showed that relative advantage, compatibility and perceived security have a positive impact on usage intention. In addition, ubiquity and trialability have a positive impact on perceived security. On the other hand, the hypotheses summary section showed that ease of use, visibility, financial risk, legal

risk, and privacy risk had no significant impact on usage intention. It may be acceptable for this study because the demographic analysis showed that half of the respondents have no cryptocurrency experience and only 18% of all respondents have experience less than one year. This indicates that the respondents of this research were early adopters. Therefore, ease of use, visibility, financial risk, legal risk, and privacy risk may not be a concern for the users at this stage. Moreover, the results show that the mean of legal risk factor is higher than other risk factors. Legal uncertainty constitutes the highest barrier in cryptocurrency adoption in e-commerce.

In addition, significant positive relationships were found between trialability and risk factors unexpectedly. This finding gives us some implications. Firstly, there are very limited e-commerce platforms, which enable consumers trying out the payment process. Therefore, trialability may in fact materialize the financial, legal and privacy risk concerns. Secondly, trialability has positive significant relationship with perceived security but has not negative relationship with risk factors. The perceived security questions might be considered for system security instead of risks in e-commerce. Therefore, people might think trying cryptocurrency payment makes system more secure but not mitigate risk factors in e-commerce. Lastly, due to very rare usage of cryptocurrency in e-commerce, people might not be aware of risks in e-commerce.

A direct path analysis was made to see if there was a direct relationship from ubiquity and trialability to usage intention and results showed that there was no significant relationship between them. Moreover, an independent sample t-test was done between cryptocurrency experienced group and inexperienced group. The results showed that there is a significant difference between two groups and the results showed that the relationship between ubiquity and perceived security (H9)

was significant for the experienced group, but it was not significant for the inexperienced group.

3.6.2 Managerial implications

The usage rate of cryptocurrencies in e-commerce is premature. The early adopters still have limited experience due to very few companies accepting cryptocurrencies as a payment option. Therefore, the findings of this thesis give initial implications to companies and executives who assess providing cryptocurrency payment service to their consumers.

Paying with cryptocurrency provides advantageous features, then other payment methods like anonymity and transfer velocity. Therefore, the executives and business analysts can bring these features into the forefront while designing the process. Anonymity can be a crucial factor for customers who avoid getting a credit card. In addition to that, it may take a long time to get the money back for return cases in e-commerce, so transfer velocity may also be an essential factor to satisfy consumer needs in payback scenarios.

In addition, the results revealed that, cryptocurrency payment is compatible with consumer's previous payment habits. Therefore, executives should design cryptocurrency payment process without putting so many differences than previous payment methods.

This study showed that ubiquity and trialability improved perceived security. Executives and customer experience managers can design a demo page in which customers simulate cryptocurrency payment. So, consumers can assess the risks and benefits of cryptocurrency payment.

3.6.3 Limitations and further research

During this research, one of the limitations encountered was to find participants who have cryptocurrency experience. Nearly half of the respondents had no experience with cryptocurrency. Therefore, their thoughts about cryptocurrency usage in e-commerce can be limited. On the other hand, gender distribution was unequal in the sample. Further research can be applied to a more representative and larger sample.

APPENDIX A

QUESTIONNAIRE

Construct	Question Id	Question	Reference
Ease of Use (EoU)	EoU1	Using cryptocurrency in e-commerce is clear and understandable.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Agarwal & Prasad, 1997) and (Moore & Benbasat, 1991)
	EoU2	I believe that using cryptocurrency in e-commerce would be easy to use.	
	EoU3	Learning to use cryptocurrency in e-commerce would be easy for me.	
	EoU4	Using cryptocurrency in e-commerce is not mentally challenging.	
Relative Advantage (RA)	RA1	Using cryptocurrency would make it easier to purchase items online.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Agarwal & Prasad, 1997) and (Moore & Benbasat, 1991)
	RA2	Using cryptocurrency would enable me to pay for items online more quickly.	
	RA3	Using cryptocurrency would make it more effective for me to pay for items online.	
	RA4	Using cryptocurrency would give me greater control over my online purchases.	
	RA5	Using cryptocurrency would be more convenient when making online purchases.	
Visibility (VIS)	VIS1	I have seen others use cryptocurrency in e-commerce.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Agarwal & Prasad, 1997) and (Moore & Benbasat, 1991)
	VIS2	It is easy to observe cryptocurrencies in e-commerce being used.	
	VIS3	I have had plenty of opportunities to see others using cryptocurrencies in e-commerce.	

Perceived Security (PS)	PS1	I feel secure about the transactions in e-commerce performed using cryptocurrency.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Kim, Ferrin, & Rao, 2008) (Lin & Luarn, 2005) (Schierz, Schilke, & Wirtz, 2010) (Shin, 2010) and (Zhou, The effect of initial trust on user adoption of mobile payment, 2011)
	PS2	The infrastructure of cryptocurrencies named Blockchain takes security measures to protect my payments.	
	PS3	The infrastructure of cryptocurrencies named Blockchain can verify the user's identity to ensure payment security.	
	PS4	The infrastructure of cryptocurrencies named Blockchain can ensure the security of payment information.	
Privacy Risk (PR)	PR1	I would not feel safe providing personal private information while using cryptocurrency exchanges for my online payments.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Dinev & Hart, 2006) (Kim, Ferrin, & Rao, 2008) (Lu, Yang, Chau, & Cao, 2011) (Tan & Teo, 2000) and (Zhou, The impact of privacy concern on user adoption of location-based services, 2011)
	PR2	I am worried about other people gaining access to my account if I use cryptocurrency exchanges for my online payments.	
	PR3	I would not feel secure sending sensitive information to cryptocurrency exchanges for my online payments.	
Ubiquity (UBQ)	UBQ1	When shopping in e-commerce, I can pay with cryptocurrency at any time.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Shin, 2010) and (Zhou, The effect of initial trust on user adoption of mobile payment, 2011)
	UBQ2	When shopping in e-commerce, I can pay with cryptocurrency from anywhere.	
	UBQ3	When shopping in e-commerce, I can pay with cryptocurrency.	
	UBQ4	When shopping in e-commerce, payment with cryptocurrency is readily available where I shop.	
	UBQ5	When shopping in e-commerce, payment with cryptocurrency is supported by vendors where I shop.	
Trialability (TRI)	TRI1	Before deciding on making an online payment with cryptocurrency, I would be able to try it out.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Agarwal

	TRI2	I know what I need to do to try out making an online payment with cryptocurrency satisfactorily.	& Prasad, 1997) and (Moore & Benbasat, 1991)
	TRI3	I can experiment with making an online payment with cryptocurrency.	
	TRI4	It would be easy to try making an online payment with cryptocurrency before committing to using it.	
Financial Risk (FR)	FR1	Financial losses are likely when I use cryptocurrency in e-commerce.	(Ryu, 2018) adapted from (Featherman & Pavlou, 2003) and (Lee, 2009)
	FR2	Financial fraud or payment frauds are likely when I use cryptocurrency in e-commerce.	
	FR3	Financial losses due to Blockchain are likely when I use cryptocurrency in e-commerce.	
Legal Risk (LR)	LR1	My use of cryptocurrency in e-commerce is uncertain due to many regulations.	(Ryu, 2018) adapted from (Barakat & Hussainey, 2013) and (Abramova & Böhme, 2016)
	LR2	It is not easy to use cryptocurrency in e-commerce due to government regulation.	
	LR3	There is a legal uncertainty for cryptocurrency users.	
Compatibility (COM)	COM1	Using cryptocurrency is compatible with all aspects of my e-commerce payments.	(Moore & Benbasat, 1991)
	COM2	I think that using cryptocurrency in e-commerce fits well with the way I like to pay online.	
	COM3	Using cryptocurrency in e-commerce fits into my payment style.	
Usage Intention (UI)	UI1	Pay with cryptocurrency is something I plan to use in e-commerce.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Davis, 1989) (Gefen, Karahanna, & Straub, 2003) and (Shin, 2010)
	UI2	Pay with cryptocurrency is something I intend to use in e-commerce.	
	UI3	Pay with cryptocurrency is something I intend to recommend the e-commerce usage to a friend.	
	UI4	Pay with cryptocurrency is something I intend to continue using in e-commerce.	

Gender

a) Female
b) Male

Age

a) Under 18
b) 18 – 23
c) 24 – 29
d) 30 – 35
e) 36 – 41
f) 42 – 50
g) 51 – 60
h) Above 60

Education

a) Primary / Secondary school
b) High school
c) Associate / Bachelor
d) Master / PhD

How long do you use cryptocurrencies for trade, payment, or mining?

a) Never
b) Less than one year
c) Between one and three years
d) More than three years

How long do you use e-commerce?

a) Never
b) Less than one year
c) Between one and three years
d) More than three years

APPENDIX B

QUESTIONNAIRE (TURKISH)

Construct	Question Id	Question	Reference
Ease of Use (EoU)	EoU1	E-ticarette kripto para ile ödeme yapmak kolay ve anlaşılırdır.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Agarwal & Prasad, 1997) and (Moore & Benbasat, 1991)
	EoU2	E-ticarette kripto para ile ödeme yapmanın kolay olacağına inanıyorum.	
	EoU3	E-ticarette kripto para ile ödeme yapmayı öğrenmek benim için kolaydır.	
	EoU4	E-ticarette kripto para ile ödeme yapmak ekstra bir çaba gerektirmez.	
Relative Advantage (RA)	RA1	Kripto para kullanmak e-ticarette ödeme yapmayı kolaylaştırır.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Agarwal & Prasad, 1997) and (Moore & Benbasat, 1991)
	RA2	Kripto para kullanmak e-ticarette ödeme yapmayı hızlandırır.	
	RA3	Kripto para kullanmak e-ticarette ödeme yapmak için daha etkin bir yoldur.	
	RA4	Kripto para kullanmak e-ticarette ödeme yaparken bana daha fazla kontrol sağlar.	
	RA5	Kripto para kullanmak e-ticarette ödeme yapmak için daha uygun bir yoldur.	
Visibility (VIS)	VIS1	Çevremdeki insanların e-ticarette kripto para kullandıklarını görüyorum.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Agarwal & Prasad, 1997) and (Moore & Benbasat, 1991)
	VIS2	E-ticarette kripto para kullanıldığını gözlemlemek kolaydır.	
	VIS3	Çevremdeki insanların e-ticarette kripto para kullandığını bir çok kez görme fırsatım oldu.	

Perceived Security (PS)	PS1	E-ticarette kripto para ile gerçekleşen işlemlerde kendimi güvende hissederim.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Kim, Ferrin, & Rao, 2008) (Lin & Luarn, 2005) (Schierz, Schilke, & Wirtz, 2010) (Shin, 2010) and (Zhou, The effect of initial trust on user adoption of mobile payment, 2011)
	PS2	Kripto paraların altyapısı olan blokzincir (blockchain) sayesinde ödemelerim güvendedir.	
	PS3	Kripto paraların altyapısı olan blokzincir (blockchain) kullanıcıların kimliklerini doğrulayarak ödeme güvenliğini sağlar.	
	PS4	Kripto paraların altyapısı olan blokzincir (blockchain) ödeme bilgilerinin güvenli bir şekilde saklanmasını sağlar.	
Privacy Risk (PR)	PR1	E-ticarette ödeme yapmak için kripto para borsalarını kullanırken kişisel bilgilerimi girdiğim için kendimi güvende hissetmiyorum.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Dinev & Hart, 2006) (Kim, Ferrin, & Rao, 2008) (Lu, Yang, Chau, & Cao, 2011) (Tan & Teo, 2000) and (Zhou, The impact of privacy concern on user adoption of location-based services, 2011)
	PR2	E-ticarette ödeme yapmak için kripto para borsalarını kullanırken diğer insanların hesabımı ele geçirmesinden endişe duyuyorum.	
	PR3	E-ticarette ödeme yapmak için kripto para borsalarını kullanırken hassas veri (kimlik fotokopisi vb.) yolladığım için kendimi güvende hissetmiyorum.	
Ubiquity (UBQ)	UBQ1	İstediğim *her an* kripto para ile e-ticarette ödeme yapabilirim.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Shin, 2010) and (Zhou, The effect of initial trust on user adoption of mobile payment, 2011)
	UBQ2	İstediğim *her yerden* kripto para ile e-ticarette ödeme yapabilirim.	
	UBQ3	E-ticarette alışveriş yaparken kripto para ile ödeme yapabilirim.	
	UBQ4	Kripto para ile ödeme seçeneği, alışveriş yaptığım e-ticaret sitelerinde mevcuttur.	
	UBQ5	Kripto para ile ödeme seçeneği, alışveriş yaptığım e-ticaret sitelerince desteklenir.	
Trialability (TRI)	TRI1	E-ticarette kripto para ile ödeme yapmaya karar vermeden evvel deneme yapmak isterim.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Agarwal & Prasad, 1997) and (Moore & Benbasat, 1991)
	TRI2	E-ticarette kripto para ile ödeme yapmayı denemek için ne yapmam gerektiğini biliyorum.	
	TRI3	E-ticarette kripto para ile ödeme yapmayı deneyebilirim	

	TRI4	E-ticarette kripto para ile ödeme yapmaya karar vermeden evvel denemek kolaydır.	
Financial Risk (FR)	FR1	E-ticarette kripto para ile ödeme yaparken maddi kayıp oluşması muhtemeldir.	(Ryu, 2018) adapted from (Featherman & Pavlou, 2003) and (Lee, 2009)
	FR2	E-ticarette kripto para ile ödeme yaparken dolandırılmak muhtemeldir.	
	FR3	E-ticarette kripto para ile ödeme yaparken blokzincir (blockchain) altyapısı yüzünden maddi kayıp yaşamak muhtemeldir.	
Legal Risk (LR)	LR1	E-ticarette kripto para ile ödeme yapmanın önünde yasal belirsizlik vardır.	(Ryu, 2018) adapted from (Barakat & Hussainey, 2013) and (Abramova & Böhme, 2016)
	LR2	Yasalar yüzünden e-ticarette kripto para kullanmak kolay değildir.	
	LR3	Kripto para kullanıcıları için yasal belirsizlik vardır.	
Compatibility (COM)	COM1	Kripto para kullanmak her bakımdan e-ticaret ödemelerimle uyumludur.	(Moore & Benbasat, 1991)
	COM2	Kripto para kullanmak e-ticarette ödeme yapma şeklimle tam anlamıyla uyumludur.	
	COM3	Kripto para kullanmak e-ticarette ödeme yapma tarzımla uyumludur.	
Usage Intention (UI)	UI1	E-ticarette kripto para ile alışveriş yapmayı planlıyorum.	(Johnson, Kiser, Washington, & Torres, 2017) adapted from (Davis, 1989) (Gefen, Karahanna, & Straub, 2003) and (Shin, 2010)
	UI2	E-ticarette kripto para ile alışveriş yapmak niyetindeyim.	
	UI3	E-ticarette kripto para ile alışveriş yapmayı arkadaşlarıma tavsiye etme niyetindeyim.	
	UI4	E-ticarette kripto para ile alışveriş yapmaya devam etmek niyetindeyim.	

Cinsiyetiniz

a) Kadın
b) Erkek

Yaşınız

a) 18'den küçük
b) 18 – 23
c) 24 – 29
d) 30 – 35
e) 36 – 41
f) 42 – 50
g) 51 – 60
h) 60'dan büyük

Eğitim düzeyiniz

a) İlköğretim / Ortaokul mezunu
b) Lise mezunu
c) Ön lisans / lisans mezunu
d)Yüksek lisans / Doktora mezunu

Bitcoin ve benzeri kripto paraları alım, satım, ödeme ve madencilik vb. faaliyetlerde ne kadar zamandır kullanıyorsunuz?

a) Hiç kullanmadım
b) 1 seneden az bir süre
c) 1 ila 3 senedir
d) 3 seneden fazla

E-ticarette ne kadar zamandır alışveriş yapıyorsunuz?

a) Hiç kullanmadım
b) 1 seneden az bir süre
c) 1 ila 3 senedir
d) 3 seneden fazla

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