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THE ACCEPTANCE OF BITCOIN IN INDONESIA: EXTENDING TAM WITH IDT

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Abstract. In 2009, the world's first completely decentralized digital currency Bitcoin was introduced by an pseudonymus programmer known as Satoshi Nakamoto. The hype of a novel currency subsequently motivates research on this phenomenon, especially focusing on what affects individuals to use Bitcoin. This paper attempts to address the issue by creating a model of technology acceptance that fits the specific and unique characteristics of the Indonesian environment by extending the Technology Acceptance Model (TAM). We incorporated the Perceived Compatibility from Innovation Diffusion Theory by Everett Rogers (1962) and added Bitcoin Knowledge, and Perceived Risk as additional external variables for TAM. The data are collected through 108 user of Bitcoin from various online forums in Indonesia and was analyzed using Partial Least Square (PLS) path modelling.The results suggested that indeed the perceived compatibility and knowledge affects user's intention towards Bitcoin. The findings of this study can prove to be useful for Bitcoin community and exchange service in formulating strategies to increase user base and contributes the literature by formulating and validating TAM to predict Bitcoin adoption.

Keywords: Technology Acceptance Model, Bitcoin, Extending TAM, Innovation Diffusion, Compatibility, Risk, Indonesia.

Introduction

The current total market capitalization of Bitcoins exceeds one billion US dollars (IEEE Spectrum magazine, 2013) and the 50,000 transactions daily (Ferrara, 2013) is a testimony of Bitcoin as a proof of concept with active users. Digital currencies are making waves politically, socially, technologically, and commercially.

Commerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments. While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust based model which is, that both companies and customers alike exposed to bank remittance charges; banker's fees; or the necessity to perform currency exchanges. With the advent of digital currencies such as Bitcoin both companies and customers are realizing that the trade restrictions and costly fees of traditional currency can be avoided.

Bitcoin certainly has the potential to support the financial and trade system. But it can be seen that

the legal status and customer protection are still in question. Indonesian goverment through Bank Indonesia is stating that Bitcoin and other virtual currencies are not currencies or legal tender in Indonesia. The people are urged to exercise caution towards Bitcoin and other virtual currencies. All risks regarding ownership or use of Bitcoin are borne by the owner or user of Bitcoin and other virtual currencies (bi.go.id)

While Bitcoin clearly still in a high-risk phase, there remains a proportion of consumers who are willing to adopt it. We have to find out what kind of factors that determine Bitcoin adoption among those who are willing to adopt it. This research will provide a data to explain and describe what factors that may have a significant impact towards the acceptance of *Bitcoin* with the help of Technology Acceptance Model (TAM) by Davis (1989) combinet with Innovation Diffusion Theory (IDT) by Rogers (1962) and several new and modified theories.

Literature Review and Hypothesis Development

2.1. Bitcoin

Bitcoin is a decentralized electronic cash system using peer-to-peer networking to enable payments between parties without relying on mutual trust. It was first described in a paper by Satoshi Nakamoto in 2009. The data of all these transactions, after being validated with a proof-of-work system, is collected into what is called the block chain. The Bitcoin scheme has no centralized issuing authority. The network is programmed to increase the money supply in a slowly increasing geometric series until the total number of Bitcoins reaches an upper limit of about 21 million BTC's (Nakamoto, 2009).

The Bitcoin system maintains a global, publicly distributed ledger of transactions, called the block chain, which is maintained through a consensus algorithm running across a large number of computers distributed across the world. These computers perform a computationally intense function called mining, which integrates the transaction into the block chain. The transaction to debit from the sender's account and credit to your account is aggregated with other pending transactions together into a block by one of these machines and posted to the head of the block chain. A block also contains a hash of the previous head block of the block chain, creating a total order on all blocks in the block chain (Nakamoto, 2010).

2.2. Extending TAM with IDT

According to Davis (1989), TAM is built for the researcher to find an explanation, why a certain technology may be unacceptable, and can find corrective steps. With the key purpose is to provide a foundation for tracing the impact of external factors on internal beliefs, attitudes, and intentions.

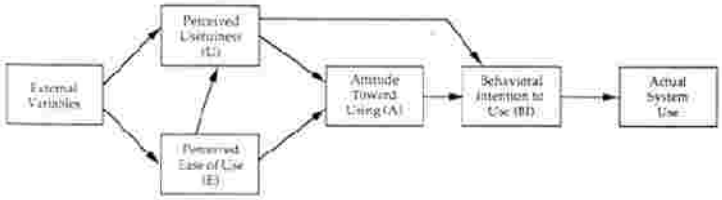

Figure 1. Technology Acceptance Model (TAM) (Davis, 1989)

After its first publication, Technology Acceptance model has been modified into some new model like there is *Technology Acceptance Model 2* (Venkatesh & Davis, 2000), *Technology Acceptance Model 3* (Venkatesh & Bala, H, n.d.), then *Unified Theory of Acceptance and Use of Technology (UTAUT)* (Venkatesh, *et al*., 2003).

IDT was proposed by Everett M. Rogers in 1962. It is used to explain how an innovation is accepted

and diffused within a social system (Rogers, 1995). It suggests a set of five innovation attributes to explain the rates of adoption by users. More specifically, Rogers (1995) postulated that an innovation is more likely to succeed and readily adopted if it has Perceived Attributes of Innovation which consist of 5 (five) factors.

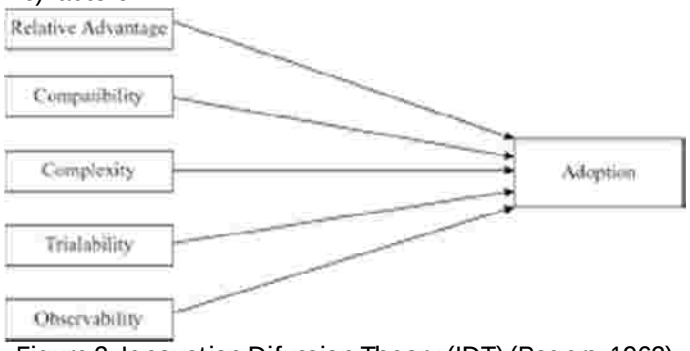

Figure 2. Innovation Difussion Theory (IDT) (Rogers, 1962)

However, recent studies (Agarwal and Prasad, 1998; Kolodinsky et al., 2004), found that only relative advantage, compatibility and complexity were consistently related to innovation adoption. Moore and Benbasat (1991) found complementary relationship between TAM and IDT, the relative advantage construct is similar to PU and the complexity construct is similar to PEOU. Thus, the only important innovation characteristic that is not included in TAM reasoning is compatibility. This suggests that TAM and IDT reconfirm each others' findings, which enhance the confidence in the validity and reliability of these approaches (Chen et al., 2002).

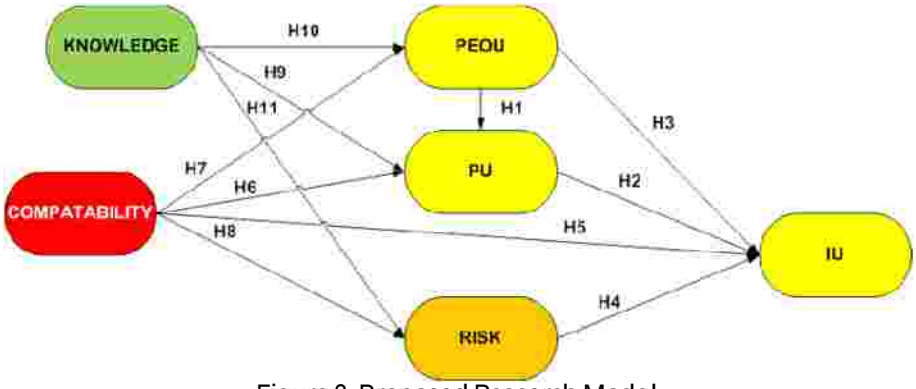

Figure 3. Proposed Research Model

2.3. Hypothesis

2.3.1. Perceived Usefulness, Perceived Ease of Use, Intended Use

Intended use is *"a behavioural tendency of people to keep using a certain technology, level of intention to use can be predicted by their behaviour towards that certain technology*" (Davis, 1989). Perceived Ease of Use is defined by Davis (1989)as *the degree to which a person believes that using a particular system would be free of effort*. While Perceived Usefulness is defined also by Davis (1989) as *the degree to which a person believes that using a particular system would enhance his or her job performance.*

There have been many studies highlighting the importance of both perceived usefulness and perceived ease of use on predicting behavior, as such it is proposed that Perceived Ease of use and Perceived usefulness directly affects intention, and that the easier it is to operate the system, the

more a person's usefulness and trust is towards the system. These situations resulting the hypothesis below:
H1: Perceived Ease-Of-Use positively affects Perceived Usefulness
H2: Perceived Usefulness positively affects Intended Use of *Bitcoin*
H3: Perceived Ease-Of-Use positively affects Intended Use of *Bitcoin*

2.3.2. Perceived Risk, Intended Use
Perceived risk in customer behavior research is defined as any action of a consumer that may lead to unpleasant consequences. Other studies have considered perceived risk as the consumer's expectations of suffering loss in pursuit of a desired outcome. However, Pavlou (2003) in his studies argue that risk rises from individuals subjectively and is difficult to capture objectively. The separation of perceived risk into sub dimensions is sometimes not accurate and cannot assess all the relevant risks' dimensions, especially when the study focuses on risky new technology like Bitcoin.
H4: Perceived Risk negatively affects Intended Use of *Bitcoin*

2.3.3. Compatibility, Perceived Usefulness, Perceived Ease of Use, Perceived Risk
Based on Agarwal and Karahanna (1998), technologies perceived to be compatible with various aspects of an individual's experiences and working styles (compatibility with existing work practices and compatibility with preferred work style) are likely to produce feelings of familiarity for the new technology and result in a faster rate of adoption (Chen et al., 2002).
However, potential customers would not adopt a new service just because of its compatibility. Oh et al. (2003) claim that PU and PEOU mediate the effects of compatibility to customers Intended Use. Individuals who feel compatible with a new technology are in a better position to evaluate the usefulness of the new technology and they are expected to find it more easy to use. Moreover, Rogers (1995) claims that "compatibility reduces uncertainty". Risk, in turn, is grounded in uncertainty (Pavlou, 2003).
H5: Compatibility positively affects Intended Use
H6: Compatibility positively affects Perceived Usefulness
H7: Compatibility positively affects Perceived Ease-Of-Use
H8: Compatibility negatively affects Perceived Risk

2.3.4. Knowledge, Perceived Usefulness, Perceived Ease-Of-Use, Perceived Risk
The Theory of Reasoned Action (Fishbein and Azjen, 1975) from which TAM was developed notes that perception about a technology are learned behavior, and should thus follow the accumulation of knowledge through experience.
Some TAM studies use experience as a proxy for knowledge (Agarwal and Prasad, 1999) while others have assessed user knowledge directly. The latter group of studies primarily examines technical knowledge, by assessing users' estimates of their own relative proficiency with computers (Venkatesh and Davis 1996).
H9: Knowledge positively affects Perceived Usefulness
H10: Knowledge positively affects Perceived Ease of Use
H11: Knowledge negatively affects Perceived Risk

Research Design

3.1. Respondents
For Structural Equation Modeling (SEM) analysis, to determine the number of sample has its own rules. According to Ferdinand, A (2002, p.51), as cited in (Ibna, A., 2009), the number of sample which must be fulfilled for using SEM is at least 100 sample (>=100). Also, using Partial Least Square

(PLS) path modeling the needed sample size is minimum 30 to 100 cases. (Yamin and Kurniawan, 2011).

There are 108 respondents who's gathered directly from *several local Bitcoin communities on various web forums. Online Bitcoin forum like indoBitcoin.org, Bitcointalk.org, fulus.com, letstalkBitcoin.com, Kaskus threads, and various Indonesian Bitcoin facebook page.*. The result of demographic background as it follows: 95% is male, 5% female. Majority of the age is 26-30 with 43%, then 21-25 with 30%, so it combined to 73%, while the rest of them on group of 30+ are covering 27%. Majority of education level is Bachelor degree (S1) with 59%, Master (S2) with 35%, and highschool graduate with 6%. In occupation, 51% working in private sector, followed by entrepreneur with 20%, IT practitioner 12%, students 11%, and banker 6%.

3.2. Measurements

In this research there are 6 constructs with the total indicators of 29: Perceived Ease of Use, Perceived Usefulness, Perceived Risk, Compatibility, Bitcoin Knowledge, and Intended Use.

Measurement scale for all indicators is using Likert scale of 1 – 6. With explanation of each the scale as follow*: 1 = Strongly Disagree, 2 = Disagree, 3 = Tend to Disagree, 4 = Tend to Agree, 5 = Agree, 6 = Strongly agree*. The decision to use Likert scale of 6 rather than traditional 5 or 7 is to avoid central tendency problem, which Indonesian people quite often if given a middle choice they will choose that answer.

3.3. Data Collection & Analysis

The data is collected through the online questionnaire by using Google form. The analysis process is helped by XLSTAT version 2014 software, which is specialized software that built to analyse interdependence problems with Partial Least Square Method (PLS).

PLS is a variance based Structural Equation Modelling (SEM). According to Haenlein (2004), PLS is an alternative approach that shifts from a covariance-based SEM approach to variance based. Covariance-based SEM generally tests causality or theories while PLS is more predictive models. PLS is a flexible analytical method because it is doesn't need many assumptions. For example, the data should not be normally distributed; the sample does not need to be big. Also, it can be used to confirm the relatively new theory.

For analysis step of Structural Equation Modelling with using Partial Least Square is the measurement model. This evaluation consists of convergent validity and discriminant validity. Convergent validity has 3 types of examination: reliability item (validity of each indicator), composite reliability and average variance extracted (AVE). Then, the last analysis step is Goodness-of-Fit Index (GoF) before evaluating the structural model as a whole.

Result and Discussion

4.1. Reliability and Validity Analysis

Validity is an extent to which a measure or set of measures correctly represents the concept of the study. It is concerned with how well the concept is defined by the measures. While, reliability is an extent to which variable or set of variables is consistent in what it is intended to measure.

Table 4.1 Reliability Item

Latent variable	Indicators	Standardized loadings	Critical ratio (CR)
PEOU	I find the system to be easy to use.	0,696	10,628
	I find the system to be easy to learn.	0,620	7,440

	My interaction with the system is clear and understandable.	0,773	14,329
	It was easy to become skilful at using the system	0,644	7,379
	I find the system to be flexible to use	0,580	5,346
PU	Using the system would improve my productivity	0,694	12,170
	Using the system would increase my efficiency in transaction	0,715	9,649
	Using the system would make my transaction easier	0,697	8,685
	Using the system would make my transaction quicker	0,591	5,939
	I find the system to be cost saving	0,658	6,619
	I find the system to be usefull	0,552	6,454
PC	The system is compatible with my lifestyle	0,737	9,248
	Using the system fits well with the way I like to manage my finances	0,697	7,052
	Using the system fits into my working style	0,825	16,786
PR	Using the system may expose me to fraud or monetary loss	0,278	0,949
	Using the system may jeopardise my privacy	0,914	5,729
	Using the system may expose me to legal problem	0,574	2,898
	I find the system to be insecure	0,719	4,210
BK	knowledge about the system	0,776	14,907
	knowledge about the benefits of the system	0,850	28,361
	knowledge about the system know-how	0,799	19,973
IU	Willingness to adopt the system	0,824	24,073
	Planning to use	0,798	23,337
	Prefer to use	0,606	6,922
	Sustainable use	0,821	26,478
	Increasing use	0,705	10,679

On first type, the reliability item is evaluated by looking into the value of loading factor (standardized loading). An indicator can be considered has a good validity if it has a value which bigger than 0.5 (Chin, 1998). There only 1 (one) variable that doesn't meet the requirements of standardized loading value, which is: PR1 (0,278<0,5). So, this variables will be excluded from further analysis.

Table 4.2 Composite Reliability

Latent variable	Dimensions	Cronbach's alpha	D.G.rho (PCA)
PEOU	5	0,685	0,799
PU	6	0,748	0,828
PC	3	0,623	0,799
PR	4	0,651	0,793
BK	3	0,737	0,852
IU	5	0,809	0,868

The measurement that used is cronbach's alpha and D.G rho (PCA). The value which is considered as acceptable for both of cronbach's alpha and D.G rho (PCA) is greater than 0.7 (Nunnally and Bernstein, 1994). Reliability between 0.6 and 0.7 may be acceptable provided that other indicators of a model's construct validity are good.

Table 4.3 Average Variance Extracted

Latent variable	Type	Mean Communalities (AVE)
PEOU	Endogenous	0,542
PU	Endogenous	0,527
PC	Exogenous	0,570
PR	Endogenous	0,560
BK	Exogenous	0,654
IU	Endogenous	0,571

All the AVE value of each latent construct is greater than 0.5. The greater of AVE value, it means also the greater of the indicators representation towards theirs construct. Forenell and Larcker (1981) suggest the standard of AVE, when the value is greater than 0.5; it can be said that the latent construct has a good convergent validity.

Table 4.4 Goodness-of-Fit Index

	GoF	Standard error	Critical ratio (CR)
Absolute	0,376	0,040	9,370
Relative	0,778	0,058	13,477
Outer model	0,986	0,027	36,978
Inner model	0,789	0,050	15,770

The structural model have GoF value of = 0.376. This value is considered as a GoFlarge because it has the value which greater than 0.36 (Cohen, 1988). It means this model has a high ability to explain the empirical data as a whole.

4.2. Evaluating Structural Model

A path coefficient between one construct to the other can be considered as significant if, the desired paths is greater than zero for positive relationship and less than zero for negative relationship (Hair *et al.*, 2010). From 11 path coefficients there are 3 path correlation of construct which not resulting statistically significant. *PC -> PR* and *BK -> PU* both have low coefficient value

and low t-value (Critical Ratio), 0,675 & 0,931<1,96. While PC -> IU only has low t-value (Critical Ratio), which is 1,239<1,96.

Table 4.5 Structural Model Results

Latent variable	Value	Standard error	t	Pr > |t|	*Results*
PEOU -> PU	0,286	0,095	3,019	0,003	Accepted
PU -> IU	0,231	0,092	2,504	0,014	Accepted
PEOU -> IU	0,385	0,092	4,189	0,000	Accepted
PR -> IU	-0,199	0,081	-2,477	0,015	Accepted
PC -> IU	0,108	0,087	1,239	0,218	Marginally Accepted
PC -> PU	0,295	0,102	2,890	0,005	Accepted
PC -> PEOU	0,212	0,103	2,055	0,042	Accepted
PC -> PR	0,077	0,115	0,675	0,501	*Not Accepted*
BK -> PU	0,098	0,106	0,931	0,354	Marginally Accepted
BK -> PEOU	0,357	0,103	3,456	0,001	Accepted
BK -> PR	-0,333	0,115	-2,909	0,004	Accepted

* Notes:
Accepted : Significant at 0.05 levels
Marginally Accepted : Significant at 0.1 levels
Not Accepted : Not Significant

Conclusion and Recommendation

5.1. Conclusion

Based on the results of hypothesis testing and interpretation of this research, which has been described in the previous chapter can be summarized as follows:

1. Perceived ease-of-use (PEOU) is positively significant towards perceived usefulness (PU). It means if Bitcoin is easier to use, the greater chance it also useful for the users to conduct transaction using Bitcoin.

2. Perceived usefulness (PU) is positively significant towards Intended Use (IU). It proves that, the more usefull Bitcoin is acting as payment method, the more it will be used by the users to conduct transaction.

3. Perceived ease-of-use (PEOU) is positively significant towards intended use (IU). This means the easiness in using Bitcoins directly influence the actual use. Easier the system to be used, the more user willing to adopt.

4. Perceived risk (PR) is significant with negative relationship towards intended use (IU). It shows that many users still treat Bitcoin with caution since its legal status and customer protection are still questionable.

5. Compatibility (PC) is insignificant towards intended use (IU). This means, compatibility does not affect the usage directly. The result is insignificant because Compatibility relationship toward Intended Use is moderated by explanatory variables which is, Perceived Usefulness, Perceived Ease-of-Use, and Perceived Risk.

6. Compatibility (PC) is positively significant towards perceived usefulness (PU). This proves that, the more compatible Bitcoin with users' lifestyle and working-style, the more usefull Bitcoin for the users.

7. Compatibility (PC) is positively significant towards perceived ease-of-use (PEOU). This proves that, the more compatible Bitcoin with users' lifestyle and working-style, users will find Bitcoin easier to use.

8. Compatibility (PC) is is insignificant towards towards perceived risk (PR). The risk in Bitcoin's case is mostly caused by its lack of customer protection. Moreover its questionable legal status also add the risk for users.

9. Bitcoin knowledge (BK) is insignificant towards perceived usefulness (PU). This means that, many users still don't have adequate knowledge about Bitcoin's benefits. This also could mean that many users are just following the trend in using Bitcoin.

10. Bitcoin knowledge (BK) is positively significant towards perceived ease-of-use (PEOU). It means, if the users have sufficient knowledge regarding Bitcoin, the easier the system to be used.

11. Bitcoin knowledge (BK) is significant with negative relationship perceived risk (PR). It shows that, sufficient knowledge about Bitcoin the users have will decrease the chance of scam/fraud and other risk in Bitcoin's usage.

In concluding this research, it can be said that if the Bitcoin system is easier to use, the greater chance it also useful to conduct transaction / payment by users. For Bitcoin community and exchange service, to expand the user base, they need to provide more campaign and education for common people about Bitcoin. Moreover, they also need to appeal to the goverment and big retailer to support Bitcoin. Without goverment backing, it is difficult for the majority of people to accept Bitcoin.

5.2 Theoretical Contribution

This research is hoped to give contribution in theoretically or in practical area. Combinging TAM with IDT itself is not a new thing for technological acceptance research. This paper is intended to increase the amount of Bitcoin acceptance research, which at the time is still lacking.

This research shows that the knowledge regarding Bitcoin and user compatibility is important for Bitcoin acceptance in Indonesia. Therefore Bitcoin promoters should continue to educate the masses about the benefits of Bitcoin.

5.3 Practical Contribution and Recommendation

1. There should be more socialization, dissemination, or seminar about Bitcoin in order to educate the masses about its benefits. This kind of activities should be organized not only by goverment but also Bitcoin communities.

2. Bitcoin community should appeal to the goverment or in this case Bank Indonesia to regulate Bitcoin. Without goverment backing, Bitcoin will be difficult to accep by majority of people.

3. Bitcoin exchange services must establish cooperation with big retailer or e-comerce site like Indomaret, Carefour, FJB Kaskus, Bhineka.com, etc. to facilitate payment with Bitcoin.

5.4 Recommendation for Further Research

1. A better sampling method is advisable, using probabilistic sampling such as simple random sampling. Using normally distributed data, then processed with AMOS or LISREL, it might create more comprehensive result to confirm a theory. The sample should be larger. Larger samples increase the chance of finding a significant difference since they are more reliably reflected the population mean.

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