READINESS AND REASONS FOR USING INTERNET OF THINGS

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Abstract

This article presents an exploration of the various factors, such as readiness, attitude and subjective norm, affecting the use of the Internet of Things (IoT). The sample of this study was 39 respondents with knowledge of the Internet of Things. The study used mean, standard deviation, correlation analysis, regression equation analysis, and path analysis as statistics tools for data analysis. The result showed that the attitude (AB) toward using Internet of Things and subjective norm in Internet of Things of the respondents were at a high level. The respondents' technology readiness was at a moderate level. The intention of using the Internet of things was at a high level. According to regression analysis, the factors that influenced the behavior intentions (BI) to use the Internet of Things were subjective norm (SN) and technology readiness index 2.0 (TRI2). The multiple linear regression equation was BI = .731SN + .239TRI2. Since there was a correlation among BI, SN, AB, and CON, a contributor group of TRI2; the path analysis was conducted. After model fitting, the causal model statistics were: χ^2 = 2.246, degree of freedom = 2, p = .323, χ^2/df = 1.123, RMR = .030, and Goodness of Fit Index = 97.2. There were two equations from fitted model which were BI =.453 CON + .515 SN and CON = .703 AB.

Keywords: TRI2, IoT, the Internet of Things

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Introduction

The Internet of Things (IoT) technology is a concept of applying the capabilities of the Internet with all smart devices and sensors which are specifically built (Ashton, 2009; Gabbai, 2015). Such devices are able to carry out various tasks without human's command. This concept was introduced by Kevin Ashton in 1999 and is now a guideline for using devices to facilitate future human beings. The concept of Internet of Things is expected to be widely deployed in 2020.

The internet provides several benefits that facilitate human lives in terms of convenience and speed due to all technological capability. Many businesses have applied the IoT technology to their online activities including promoting and advertising their products and services through various available channels, such as company website, social media or online television (Jotikasthira & Onputtha, 2017). In particular, the Internet helps business operators to reach more diverse target groups and save business operation cost, such as shop rent, advertising cost and so forth. In addition, the IoT can also assist business operators to track their customers' satisfaction through the customers' comments towards the products or services posted on social media. Besides the business relevance, the human's daily life activities, such as commutating with friends, searching news, ordering foods and basic need of life, teaching and learning, nursing and others are also on the Internet (Kuo, Liu, & Ma, 2013; Madakam, Ramaswamy, & Tripathi, 2015).

Since there is an engagement between Internet of Things and human beings, it is necessary to understand people behaviors in order to prepare, educate, and change to obtain a good outcome of Internet of Things in the future before it is fully implemented. The objective of this study was to study behavioral intention, to use Internet of Things and to analyze certain factors that influenced behavioral intention.

Literature Reviews

Internet of Things

The term "The Internet of Things" or IoTs, was created by Kevin Ashton (2009; Gabbai, 2015), innovator and consumer sensor expert, in 1999. He claimed that this phase was in presentation that he made at Procter & Gamble. The phase came up to replace an old "Internet like" phase. He described that *Internet of Things made computer and devices to sense things for themselves. There was many billion times more information in the world than people could possibly type in through a keyboard or scan with a barcode by IoT.* According to his description, the Internet of Things is not only using internet to control, but to exchange information and apply such information to create a better living for users**.**

Theory of Reasonable

TRA stands for the theory of reasoned action which was developed by Icek Ajzen and Martin Fishbein in 1967 (Fishbein, & Ajzen, 1985; Ajzen, & Fishbein, 1980; Rangsom, & Khan-am, 2018;

Khan-am, 2017) and was reviewed and expended by its creator again in 1980. The theory contents are to predict intention to act, understand factors that influence behaviors. The variables in this theory are attitude toward behavioral, including behavioral belief and evaluation of behavioral outcome; subjective norm (SN) includes normative belief and motivation to comply; and behavioral intention (BI) refers to the individual's intention to perform a behavior. The relationship among these variables are shown in the equation as follows:

$$BI = W_1AB + W_2SN$$

Where W_1 and W_2 is an empirical weight

The TRA is a predecessor of other theories, such as Technology Acceptance Model (Davis, 1986; Davis, 1989; Khan-am, 2017; Rangsom & Khan-am, 2018) and Theory of Planning Behavior (Ajzen, 1985) which were applied to several models and theories

Technology Readiness Index

The Technology Readiness Index, TRI, was developed by Parasuraman in 2000. The definition of this theory is "*people's propensity to embrace and use new technologies for accomplishing goals in home life and at work*" (Parasuramen, 2000; Rangsom, & Khan-am, 2018). Therefore, TRI is a list of indicators for measuring an individual's beliefs and thoughts towards a technology. This indicator has been widely used in academic and commercial contexts, and has been used as an instrument for a long term. The TRI consisted of 36 items.

There are two groups of componential technology readiness. Grouping has been done on positive and negative beliefs of technology in a more complex way. Parasuraman (2000) Rangsom and Khan-am (2018) stated that those who are optimistic and innovative with lesser discomfort and insecurity tend to be more ready to use a new technology. The components of TRI include Optimism which refers to *"a positive view of technology and belief that offers people increased control, efficiency, and flexibility in their lives*"; Innovativeness which is "*a tendency to be an early adopter of technology and opinion leader*"; Discomfort which is defined as "*a perception of being unable to control the technology and a feeling of being overwhelmed by it*"; and Insecurity which is "*suspicion of technology and doubt about its capability to work*" (Parasuramen, 2000; Rangsom, & Khan-am, 2018). The new index of technology readiness is called TRI 2.0. Those items were divided to contributors and inhibitors. Contributors include Optimism and Innovativeness while inhibitor include of Discomfort and Insecurity. Additionally, optimism consisted by OPT2, and OPT4; Innovativeness consisted by INN1, INN2, and INN4; Discomfort consisted by DIS2, DIS3; and Insecurity consisted by INS1, INS2, and INS3.

This concept was applied in several articles, such as "A technology acceptance model for empirically testing new end-user information systems: Theory and results" (Davis, 1985), "An investigation of the effect of nurses' technology readiness on the acceptance of mobile electronic

medical record systems" (Kuo, Liu, & Ma, 2013), "Technology Readiness and Technology Acceptance Model in New Technology Implementation Process in Low Technology SMEs" (Larasati, & Santosa, 2017). This concept also integrated with TAM model to produce a Technology Readiness and Acceptance Model, TRAM (Kua et al, 2007; Larasati, & Santosa, 2017; Khan-am, 2017; Rangsom, & Khan-am, 2018).

Methodology

Research Design

The objective of this research was to find a factor affecting behavioral intention toward using Internet of Things. The sample of this research were 39 students of information systems program with knowledge in Internet of Thing. They were asked to answer questionnaire based on voluntary basis.

The questionnaire was developed by literatures and used as an instrument to collect data from the sample. There were seven sections of questionnaire as shown in the table below.

Table1 Sections in questionnaire.

Section	Number of question
Optimism (OPT)	4
Innovativeness (INN)	4
Discomfort (DIS)	4
Insecurity (INS)	4
Attitude toward behavioral (AB)	2
Subjective Norm (SN)	3
Behavior intention (BI)	3

The developed questionnaire was created by google form. The respondent data was administered in the INTERNET system.

The measurement of question in this study was 5 LIKERT-scale which consisted of very low, low, moderate, high, and very high. The values of scale were

1 very low
2 low
3 moderate
4 high
5 very high

The data was collected and analyzed by statistics tool. The means in this study were descriptive statistics, correlation analysis, multiple regression analysis and path analysis. The descriptive statistics were mean, standard deviation, and reliability. The hypothesis test was correlation analysis, multiple regression analysis and path analysis.

The criterion for analysis fit model show in the next table (Rangsom, & Khan-am, 2018).

Table 2 Criterion of fitting model

Statistics	Criteria
Chi-square	-
Degree of freedom	-
Probability level	> .05
Chi-square/DF	< 2

Table 2 Criterion of fitting model (Cont.)

Statistics	Criteria
RMR	< .05
CFI	> .90
GFI	> 90
RMSEA	< .05

According to a literature review, the conceptual model of this study was created as:

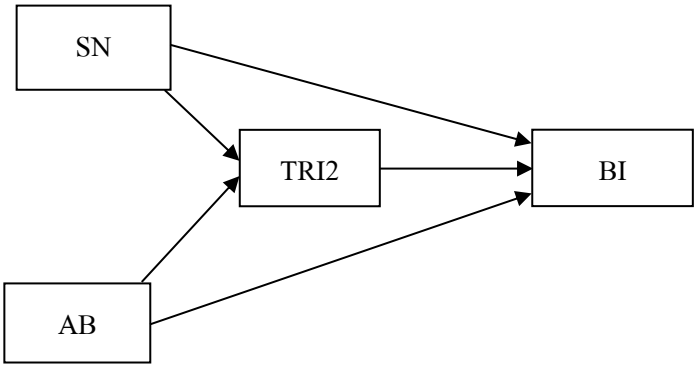

Figure 1 Research model

In conceptual model, there were four variables comprised by:

SN as Subjective belief

AB as Attitude toward Internet of Things

TRI as Technology Readiness Index

BI as Behavior Intention to using Internet of Things

Hypotheses

After the research model was settled, the hypotheses of research model were:

H1: Subjective Norm had a positive influence on Behavior Intention.

H2: Subjective Norm had a positive influence on Technology Readiness Index 2.0.

H3: Attitude toward Behavior has a positive influence on Behavior Intention.

H4: Attitude toward Behavior has a positive influence on Technology Readiness Index 2.0.

H5: Technology Readiness Index 2.0 has a positive influence on Behavior Intention.

Results

Finding

After data analysis process, the result of operation was divided into four sections as descriptive, correlation analysis, multiple regression analysis and path analysis.

Descriptive

The first section of a result is descriptive result. This section shows a description of attitude toward Internet of Things, Subjective Norm of respondents and Behavior Intention.

Table 3 Descriptive Attribute and Subject Norm

Category	Value	Mean	S.D.	Explanation
Attitude	Belief in usefulness of Internet of Things	3.667	.806	High
	Internet of Things make efficiency works	3.718	.971	High
	Average	3.692	.855	High
Subjective Norm	Others use IoT	3.589	.880	High
	Experts use IoT	3.718	.916	High
	I follow others & experts	3.410	.880	Moderate
	Average	3.572	.768	High

According to Table 3, the result shows the attitude toward Internet of Things is at high level in all aspects. Belief in usefulness of Internet of Things (3.667), and Internet of Things make efficiency works (3.718), and the average of attitude toward Internet of Things (3.692) are all at high level. The subjective norm of Internet of Thing has a high level in two aspects; others use Internet of Things (3.589), and Expert use Internet of Things (3.718). The average of subjective norm also affects Internet of Things at a high level (3.410). It is at high level for subjective norm with I follow others & Experts aspect (3.572).

The next table shows technology readiness index to measure how respondents open for new technology.

Table 4 Descriptive Technology Readiness Index

Category	Value	Mean	S.D.	Explanation
Contributor (CON)	Optimism	4.096	1.072	High
	Innovativeness	3.667	.872	High
	Average	3.881	.911	High
Inhibitor (INH)	Discomfort	2.840	.689	Moderate
	Insecurity	2.558	.816	Moderate
	Average	2.698	.634	Moderate
Technology Readiness Index 2.0 (TRI2)	-	3.290	.368	Moderate

According to table 4, the result shows that the contributor characteristic of respondent is at high level (3.881) in all aspects including optimism (4.096) and innovativeness (3.667). However, the inhibitor characteristic of respondent is at moderate level (2.698) in all aspects, such as discomfort (2.840) and insecurity (2.558).

The following table describes a behavioral intention for using Internet of Things.

Table 5 Descriptive Behavioral Intention

Category	Value	Mean	S.D.	Explanation
Behavioral Intention	Using IoTs is a good experience	3.641	.931	High
	I'll use IoTs	3.641	.959	High
	I advise other to use IoTs	3.615	.989	High
	Average	3.632	.907	High

According to table 5, the table shows the average of behavior intention of respondent for using Internet of Things is at high level (3.632). Using Internet of Things is a good experience (3.641), respondents will use Internet of Things in the future (3.641), and respondent will advise people to use Internet of Things (3.615) are also high.

Correlation Analysis

The correlation test was employed for testing a relationship among any affected factors including Subjective Norm (SN), Attribute toward Internet of Things (AB), Contributor (CON), Inhibitor (INH) and TRI2; and dependent variables, such as Intention to use Internet of Things (BI). The result of correlation test is presented in Table 6.

Table 6 Result of correlation test

Variable	BI	SN	AB	CON	INH	TRI2
BI	1	.796**	.721**	.776**	-.605**	.439**
SN		1	.796**	.662**	-.633**	.273
AB			1	.703**	-.681**	.283
CON				1	-.597**	.723**
INH					1	.123
TRI2						1

** 0.01 Significant

According to Table 6, there are various relationships among the factors and intention to use Internet of Things. Those relationships are:

1. Subjective Norm, Attitude, and Contributor which have a positive relationship with Behavior Intention at high level.
2. Attitude and Contributor which have a positive relationship with Subjective Norm at high level.
3. Contributor which has a positive relationship with Attitude at high level also.
4. Inhibitor which has a negative relationship to Behavioral Intention, Subjective Norm, and Attitude at a high level; and has a relationship with Contributor at a moderate level.

Since there is no correlation between attitude toward Internet of Things and Technology Readiness Index 2.0 and no correlation between subjective norm of Internet of Things and Technology Readiness Index 2.0

Regression Analysis

As a result of correlation testing, a regression analysis was conducted to test a prediction of behavioral intention to use Internet of Things to find out appropriate predictors. The result of the analysis is presented in reliability and regression table below.

Table 7 Result of Reliability Test

Variable	α
Technology Readiness Index 2.0 (TRI2)	.911
Attitude toward behavioral (AB)	.911
Subjective Norm (SN)	.826
Behavioral intention (BI)	.940

Each Cronbach alpha value of factors and dependent variable is more than .7. Therefore, all variables are suitable to conduct a regression analysis. The statistics of regression analysis is shown in Table 8.

Table 8 Regression Table

Predictor	B	S.E	β	t-value	p-value
(constant)	-1.391	.785		-1.773	.085
SN	.863	.114	.731	7.541	.000**
TRI2	.590	.238	.239	2.468	.018*
	F			**39.524****	
	R^2			**.687**	

* 0.05 Significant

** 0.01 Significant

The statistics table shows that the tested model is appropriate for prediction. With the result of regression test model, there are two predictors chosen from stepwise method of regression analysis including subjective norm and technology readiness index 2.0. The equation from regression is written as:

$$BI = .731SN + .239\ TRI2$$

Two predictors, Subjective norm (SN) and Technology Readiness Index 2.0 (TRI 2.0) as in the equation can determine Behavioral Intention (BI) value as 68.7%.

The next table is a summary of hypotheses test.

Table 9 Summary of Hypothesis Test

Hypotheses	Significant	Explanation
Subjective Norm has a positive influence to Behavior Intention	Significant	Accept
Subjective Norm has a positive influence to Technology Readiness Index 2.0	Non-significant	Reject
Attitude toward Behavior has a positive influence to Behavior Intention	Non-significant	Reject
Attitude toward Behavior has a positive influence to Technology Readiness Index 2.0	Non-significant	Reject
Technology Readiness Index 2.0 has a positive influence to Behavior Intention	Significant	Accept

According to the Table 9, there are two hypotheses; H1 and H5 that passed a test while the others; H2, H3, and H4 failed.

Path Analysis

Although correlation test demonstrates that there is no influence from SN or AB to TRI2, it shows that there are some correlations among BI, SN, AB, CON, and INH. The path model analysis was conducted to analyze those significant correlations to produce a causal model. The result of causal model is shown in Figure 2.

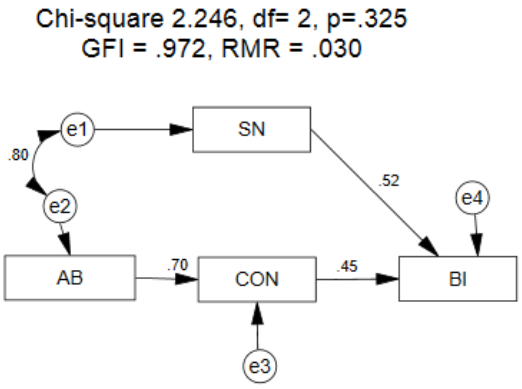

Figure 2 Casual Model

In casual model, there are only three relationships which are

1. Relationship between Subjective Norm and Behavioral Intention
2. Relationship between Contribution and Behavior Intention, and
3. Relationship between Attitude and Contributor

The relationship between subjective norm and contributor and the relationship between attitude and behavioral intention are dropped for fitting model. The statistics of fitting model is shown in Table 10.

Table 10 Model Statistics

Statistics	Criteria	Value
Chi-square	-	2.246
Degree of freedom	-	2
Probability level	> .05	.325
Chi-square/DF	< 2	1.123
RMR	< .05	0.30
CFI	> .90	99.8
GFI	> 90	97.2
RMSEA	< .05	.057

The statistics of causal model shows that the purposed model is fitted, χ^2 is not significant (p= .325 > .05), χ^2/df (1.123) is less than 2.0 RMR (0.30) less than .05, and CFI (99.8) and GFI (97.2) more than 90. The t-test value of model presented in Table 11.

Table 11 Model T-value

Pair	t-test value	Explanation
AB --> CON	6.094**	Significant
SN --> BI	4.600**	Significant
CON --> BI	4.050**	Significant

** 0.01 significant

According to Table 11, all coefficients value of factors and dependent variables are significant. The effect among variables is shown in Table 12.

Table 12 Direct and Indirect Effect

Variable	AB			SN			CON		
	DE	***IE***	***TE***	***DE***	***IE***	***TE***	***DE***	***IE***	***TE***
BI	-	.319	.319	.515	-	.515	.453	-	.453
CON	.703	-	.703	-	-	-	-	-	-

Table 12 shows that the total effect from AB to BI is .319 which is an indirect effect via CON. There are only direct effects for SN and CON to BI and the total effect from SN and CON to BI are .515, .453 respectively. The model was written as follows:

BI =.453 CON + .515 SN

CON = .703 AB.

Conclusion and Discussion

In summary, the result of this study shows that the factors affecting Behavioral Intention are Subjective Norm, and Technology Readiness Index 2.0. With path analysis, the determined factors for Behavioral Intention of using Internet of Things are Subjective Norm, Contributor, and Attitude. Both Subjective Norm and Contributor have only a direct effect on Behavioral Intention, whereas Attitude has an indirect effect on Behavioral Intention via Contributor.

The result was correspondent to the research done by Prasuramen (2000) and Rangsom, & Khan-am (2018) that the technology readiness needed to be relied on the individual's beliefs and thoughts towards a technology. The users could envisage the propensity of using new technologies to

accomplish goals at home and at work. This was set in the technology readiness index which consisted of optimistic and innovativeness. The optimism referred to a positive view of technology and belief that offered people increased control, efficiency, and flexibility in their lives. In the meantime, the innovativeness is a tendency to be an early adopter of technology and opinion leader. The two components are related to the users' attitudes. However, the IoT can be accepted or does not depend on the ability of the technology in terms of convenience or difficulty when used or applied (Davis, 1989). The IoT should be friendly to users since many people are still worried about how to use it. If it is not usable or friendly enough, people may feel fear and do not dare to use it. It is also important that there should be experts who can give and share some knowledge in order to increase knowledge of using IoT.

In conclusion, the result of this study shows that using the Internet of Things will be obtained a good outcome if users have a good contribution on technology and are promoted to build a subjective norm about the Internet of Things. The approach for users to contribute is based on their attitude toward the Internet of Things.

Recommendations

Recommendations from study

The results of this research can confirm that subjective norm, contributor and attitude can influence the Internet of Thing technology acceptance. Therefore, any business or organization which is going to use the Internet of Thing technology for their activities needs to consider how to create the users' attitudes. Giving more information and benefits of the Internet of Things by the experts can create good results to the work and life activities. Also, businesses or organizations should set the environment to foster the use of the Internet of Things because the technology acceptance can also be influenced by surrounding people.

Recommendations for future researches

Since the study was conducted in a small scale of respondents, the further research should select more numbers of respondents which will affect the research result. Also, this study merely focused on the quantitative research methodology; therefore, the next research should employ qualitative research methodology, such as interview or focus group for deeper understanding. In addition, the next research should diversify the industry of the implementation of the Internet of Things. Different industries that use the Internet of Thing can generate different points to accept the users' use of Internet of Things.

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