Technology Readiness and Technology Acceptance Model in New Technology Implementation Process in Low Technology SMEs

Niken Larasati, Widyawan, and Paulus I. Santosa

***Abstract*—Technological readiness and User Acceptance is increasingly being used as a guide in the process of new technologies implementation. This approach can be measured using the collaboration of Technology Readiness Index (TRI) and Technology Acceptance Model (TAM) by analyzing the implementation of new technologies adaptation construct in a particular industry group.**

This paper investigates the collected data from 40 subjects representing 222 Craft Micro, Small and Medium Enterprise in Yogyakarta Regency, Indonesia. The approach tested to the implementation of an integrated information system, in this case an Enterprise Resource Planning (ERP) that is designed in four simple modules, such as Production, Sales, Marketing and Finance according to ERP research on SMEs in Indonesia conducted by other earlier researchers.

***Index Terms*—ERP, SME, technology readiness, technology acceptance.**

I. Introduction

Indonesian Creative Industries housed within a relationship between intellectuals, business and government [1] which become the main driver of the cause of creativity, science and technology for the growth of the creative industries. The foundation of the creative industries are Indonesian human resources (people) which is the most important element in the creative industry [2]. Economic Forum of Yogyakarta Region, Indonesia in 2015 shows that the Low Technology Utilization is one of the strategic issues that cause development demotivation of MSMEs. Usability of ERP systems attented to small and medium enterprises [3]. The readiness of individuals is one of the attention in determining the factors that predispose a person towards an integrated information system. This readiness is measured by Technology Readiness Index (TRI). The method developed by Parasuraman consists of four dimensions, optimism, innovativeness, discomfort and insecurity [4].

The MSMEs classification used in this research followed the MSMEs classification which was mapped by the Center of Integrated Business Services of Cooperatives and Micro, Small and Medium Enterprises; Fashion, Services and Trading, Crafts, Cooperatives, Foods/Culinary and beverages, Fisheries, Agricultures and Livestock.

ERP application could be one of the solutions to help simplifying, integrating, and automating MSMEs business process. In practice, using ERP-based application could enable and facilitate a strong interaction between production, sales, finance, and marketing where everyone can be in the one same page. Thus, MSMEs will be helped in developing the understanding on how various business processes can be integrated and affect each other in these processes [5].

ERP system combines business process. All the incorporated business processes can access a centralized database and transmit the information to other parts of the business in real time [6]-[8]. The existing data can be used to help the companies to plan and control decisions in the future [9]. Based on the description above, the present study will be collaborated concept of TRI and TAM to determine the readiness and acceptance of SMEs based creative industries, especially in the Craft Sector on the implementation of the ERP to optimize business processes.

The paper is organized in the following order: In the next section, the authors explore the theoretical background. In the third section, authors discuss the twelve hypotheses in the research model. In the fourth section, methodology is analized and in the fifth section the result are presented. At the end, the Conclusion and discussion section is added.

II. Theoretical Model

The strong position of SMEs in national development policy refers to the Presidential Instruction issued in 2007 and 2008 on Development Acceleration of SMEs explained the government efforts in businesses facilitating to improve the ability of small and medium enterprises in the development of design and technology.

Muslihah [10] established a framework derived from in-depth study on TAM, TAM2, UTAUT, TAM3 and TRI. TRI TAM and constructs used to people in the working base typically use technological innovations based on the demands of the company's management (non-mandatory) [11]. The effect of technology readiness to technology acceptance on mandatory system was conducted by Esen and Erdogmus [12] and Marisa Eka Putra [13].

Actual Use as one of TAM variables was used along with Perceived of usefulness, Perceived ease of use and 4 TRI variables, Optimism, Innovativeness, Discomfort and Insecurity in Godoe and Johansen's [14] research.

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TRAM (Technology Readiness and Acceptance Model) is the newest contribution which combines TRI's common personality dimension with TAM's specific dimension system. This explains how the dimensions of personality can affect a person's experience and the way he uses new technology. TRI personality dimensions are antecedent to TAM. In this case, the inclusion of Actual Use will complement the earlier conducted researches [4].

A. Component of Technology Readiness

To measure a person's general beliefs and thoughts towards a technology, the approach used was Technology Readiness Index. TRI was chosen since it could differentiate whether a person was a technology user or not. It also could group users based on positive and negative beliefs to the technology in more complex way [15]. Parasuraman [6] identifies that someone who is optimistic and innovative as well as has lesser discomfort and insecurity felling will be more ready to use new technology, they are Optimism, Innovativeness, Discomfort and Insecurity.

B. Component of Technology Acceptance

Based to TAM, an individual who has perception that a technology is beneficial and easy to use will develop positive attitude and willingness as well as directs them to receive and use the technology [16] in 5 contructs: Perceived of Usefulness, Perceived Ease of Use, Attitude Toward Using, Behavioral Intention and Actual Use [17].

On TAM2, Venkatesh eliminates user attitude construct (Attitude Toward Using) since it has a negative influence (not supported) towards user behavior (Behavioral Intention to Use) [18].

C. Technology Readiness and Technology Acceptance Model

This approach is firstly stated by Lin *et al.* [11]. However, in the newest research conducted by Walczuch [19] technology readiness construct is associated directly with TAM's dimension (Perceived of Usefulness and Perceived Ease of Usefulness).

There are some different versions of users' acceptance model, but basically the models have the same main idea. All users' acceptance models have a similarity that the tendency to use a technology relies on the personal individual's perception of the technology, the value of the technology, and the ease of its use [20].

A research model was formulated with the hypotheses as follows:

H1 : A technology affects positively to perceived of usefulness technology
H2 : Users' optimism towards a technology affects positively to perceived of usefulness technology
H3 : Users' innovativeness towards a technology affects positively to perceived of usefulness technology
H4 : Users' innovativeness towards a technology affects positively to perceived ease of usefulness
H5 : Discomfort felt by users towards a technology affects negatively to perceived of usefulness technology
H6 : Discomfort felt by users towards a technology affects positively to perceived ease of usefulness
H7 : Insecurity felt by users towards a technology affects positively to perceived of usefulness technology
H8 : Insecurity felt by users towards a technology affects positively to perceived ease of usefulness
H9 : Perceived ease of usefulness system affects positively towards perceived of usefulness technology
H10 : Perceived of usefulness technology affects positively towards the Behavioral intention using technology
H11 : Perceived ease of usefulness technology affects positively towards the Behavioral intention in using technology
H12 : Behavioral intention to use a technology affects positively towards actual usefulness.

The hypotheses based on two theories in early researches by Parasuraman's Technology Readiness Index and Davis's Technology Acceptance Model. Research model of Crafts MSMEs' acceptance towards ERP technology can be seen in Fig. 1.

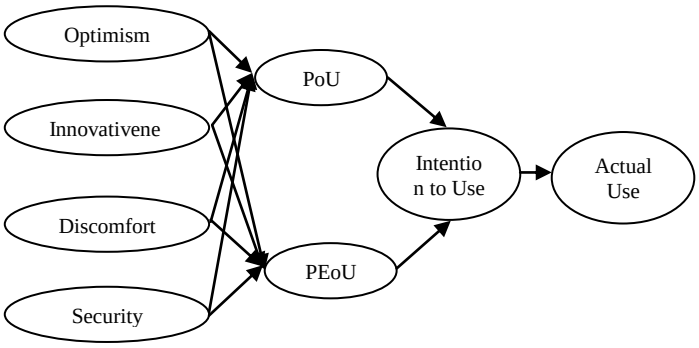

Fig. 1. Research model.

III. Methodology

A. Research Method and Data Collection

Our respondents in this research were Craft MSMEs which became beneficiaries from Integrated Business Services of Micro, Small and Medium Enterprises in Yogyakarta Regency, Indonesia. Respondents were screened to ensure that they had known the targeted ERP application, resulting 40 usable responses from 222 collected data.

The minimal sample in this study was adjusted based on the analysis model used by software tools for partial least squares. The required number of the respondents as the minimum sample was 5 times of the most complex construct items [21].

B. Operational of Constructs

The data from statistics analysis to the results of distributing questionnaire conducted to users, whether the users who have been using ERP application and those who have never been for their daily business.

A prefaced letter in each questionnaire explained the objective of the survey. The questionnaire was divided into Technology Readiness and Technology Acceptance in correspondence with this research needs. The indicators were used to represent the constructs can be seen in Table I.

TABLE I: INDICATORS

Variable	Indicator
Optimism	6
Innovativeness	6
Discomfort	6
Insecurity	6
Perceived of Usefulness (PoU)	5
Perceived Ease of Usefulness (PEoU)	5
Intention to Use	5
Actual Use	5

In this research, Likert scale was used to measure attitude, opinions, and perceptions of a person to the social phenomena and used 6 points of Likert Scale where every responds of each items was represented by "Strongly Disagree" on number 1 to "Strongly Agree" on number 6 gradation, that can be seen in Fig. 2.

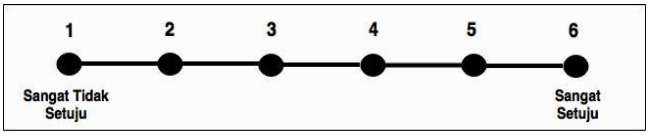

Fig. 2. Likert scale 6 points [22].

The middle value (neutral) was not used to avoid respondents' neutral responds because of their confusion since this research discussed a new technology that needed respondents' knowledge. The reliability score of Likert Scale with 6 points is higher than Likert Scale with 5 points [22].

C. Instrument Validation

The standard of reliability of the research was stated if loading factor from each indicators are worth more than or equal to 0.7 and the score of composite reliability of each constructs was worth more than 0.7 [23]. However, Hair *et al.* [23] states that the initial research of the development of measurement scale loading value of 0.6 to 0.7 is considered sufficient. This research used loading score more than 0.7.

In accordance with Ghozali [24], models have sufficient discriminant validity if the AVE root for each variable is greater than the correlation between variables with other variables. AVE roots and the correlations between variables are shown in the Table II.

TABLE II: AVE LATENT VARIABLE VALUE AFTER RETESTING

Optimism	0,606
Innovativeness	0,644
Discomfort	0,720
Insecurity	0,753
Perceived of Usefulness	0,719
Perceived Ease of Use	0,689
Intention to use	0,645
Actual Use	0,758

Source: PLS processed data result, 2016

Based on Table II, the value of AVE for each latent variable review has loading factor value above 0.50, thus it provided good convergent value.

Reliability test variables can be done in two criteria: Reliability and Cronbach Alpha compositing of block indicator that measures variables. Ghozali believes that the variable is stated as reliable if the value of the composite reliability and Cronbach Alpha value are more than 0.7, shown in the Table III.

TABLE III: CRONBACH ALPHA VALUE AND COMPOSITE RELIABILITY

	Cronbach's Alpha	Composite Reliability
Innovativeness	0,752	0,824
PoU	0,852	0,896
Intention to Use	0,806	0,865
PEoU	0,887	0,917
Optimism	0,819	0,868
Actual Use	0,760	0,837
Insecurity	0,747	0,704
Discomfort	0,748	0,885

Source: PLS processed data result, 2016

Table III shows that the value of composite reliability of all the variables were more than 0.7. It can be concluded that all variables in this study model were reliable.

Inner structural model was carried out to determine the relation among the latent variables in the research model. Structural model testing was done by calculating the t-value from the lanes coefficient and R-square value on significance level (alpha) of 0.05 with two-tailed test (two-tailed test). T-value was used to test the hypothesis proposed in the study whether they were accepted or rejected by comparing the value of the t-value with t-table (1.96) shown in Table IV.

TABLE IV: T-VALUE RESULT FOR EACH LANES

Lanes	Lanes' Coefficient	T value	Explanation
Inno → PoU	0,285	2,046	Significant
Inno → PEoU	0,284	1,791	Significant
PoU → Intention to Use	0,669	6,441	Significant
Intention to Use → Actual Use	0,672	11,115	Significant
PEoU → Intention to Use	0,027	0,175	Insignificant
Opt → PoU	-0,065	0,269	Insignificant
Opt → PEoU	0,443	2,850	Significant
Insecurity → PoU	0,172	1,311	Insignificant
Insecurity → PEoU	0,044	0,294	Insignificant
Discomfort → PoU	0,213	1,111	Insignificant
Discomfort → PEoU	0,054	0,442	Insignificant

Source: PLS processed data result, 2016

Further, the R^2 value of each of endogenous variables was tested. In this study, the endogenous variables consisted of Perceived Usefulness, Perceived ease of use, Intention to Use and Actual Use. R^2 value is greater than 0.20 in studies that tested the behavior (behavior), is already showing good results. Table V below shows the R^2 value of endogenous variable.

TABLE V: R^2 (R-SQUARE) VALUE

Endogenous Variable	R-Square
Perceived of usefulness	0,434
Perceived ease of use	0,467
Intention to use	0,398
Actual Use	0,452

Source: PLS processed data result, 2016

Based on the evaluation of structural model, the validity of the proposed hypotheses can be found out, so that they can be accepted or rejected. The hypothesis was accepted if the value of the t-value was greater than the value of t-table (1.671), and vice versa.

Structural model testing was done by calculating the t-value from the lanes coefficient and R-square value on significance level (alpha) of 0.05 with two-tailed test (two-tailed test). T-value was used to test the hypothesis proposed in the study whether they were accepted or rejected by comparing the value of the t-value with t-table (1.96) [23].

Table VI shows the hypotheses that were accepted and rejected based on the test results of the structural model at significance level of 0.05 using two-tailed test.

TABLE VI: HYPOTHESIS TEST

Lanes	Hypothesis	T value	Explanation
Opt → PoU	H1	0,269	Hypothesis was rejected
Opt → PEoU	H2	2,850	Hypothesis was accepted
Inno → PoU	H3	2,046	Hypothesis was accepted
Inno → PEoU	H4	1,791	Hypothesis was accepted
Discomfort → PoU	H5	1,111	Hypothesis was rejected
Discomfort → PEoU	H6	0,442	Hypothesis was rejected
Insecurity → PoU	H7	1,311	Hypothesis was rejected
Insecurity →PEoU	H8	0,294	Hypothesis was rejected
PEoU → PoU	H9	1,371	Hypothesis was rejected
PoU → Intention to Use	H10	6,441	Hypothesis was accepted
PEoU → Intention to Use	H11	0,175	Hypothesis was rejected
Intention to Use → Actual Use	H12	11,115	Hypothesis was accepted

Source: PLS processed data result, 2016

IV. CONCLUSION

The major finding of MSMEs readiness to the acceptance of ERP implementation on Crafts MSMEs reveal that constructs of Technology Readiness have different effect on Perceived of Usefulness and Perceived Ease of Use about ERP implementation. By considering the findings and the objectives of this research, it can be concluded that Optimism of a person that technology would improve control, flexibility, and efficiency in life influence only to Perceived Ease of Use, different from finding of previous studies.

Innovativeness which explains the tendency of a person to be the first to use the new technology influences Perceived of Usefulness and Perceived Ease of Use, similar with previous studies [12], [20]. Perceived Usefulness influences Intention to Use. On Crafts MSMEs, Perceived of Usefulness which was experienced on technology brought the users intention to use it since the needed business and resources to operate the technology was not really substantial

Intention to Use influences significantly to Actual Use. This was in line with the prior studies that used Technology Acceptance stating that the use of technology's intention affects actual usefulness significantly. In this research, this happened because the appropriateness of the use and the procedure brought satisfaction to the use of integrated information systems, including ERP.

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REFERENCES

[1] M. Mufli, "Indonesia-ASEAN market network: Strengthening national product market strategies in South-East Asia region (Case study product creative industries)," *Indonesian Readiness to Welcome ASEAN Economic 2015*, vol. II, p. 84, 2014.

[2] Ministry of Trade Republic of Indonesia, "Development of creative economy Indonesia 2009," Jakarta, 2008.

[3] V. Everdingen, Hillegersberg, and Waarts, "ERP adoption by european midsize companies: Searching for ERP systems offering a perfect fit," *Commun*., ACM, vol. 43, no. 4, pp. 27–31, 2000.

[4] A. Parasuraman, "Technology readiness index (Tri): A multiple-item scale to measure readiness to embrace new technologies," *J. Serv. Res.*, vol. 2, no. 4, pp. 307–320, 2000.

[5] J. W. Saputro, "Research roadmap of enterprise resource planning (ERP) for SMEs in Indonesia," pp. 140–145, 2008.

[6] A. N. Parr and G. Shanks, "A taxonomy of ERP implementation approaches," in *Proc. the 33rd Annual Hawaii International Conference on System Sciences*, 2000, vol. 1, p. 10.

[7] N. Guhr, T. Loi, R. Wiegard, and M. H. Breitner, "Technology readiness in customers' perception and acceptance of mobile-payment : An empirical study in Finland, Germany, the USA and Japan," in *Proc. Int. Conf. Wirtschaftsinformatik*, March, 2013, pp. 119–133.

[8] N. Slack, S. Chambers, and R. Johnston, *Operations Management*, 2010.

[9] M. Aisyah, "Using enterprise resource planning (ERP) for enhancing business processes in small and medium enterprises (SMEs)," *J. Pendidik. Akunt. Indones.*, 2011.

[10] M. Wook, Z. Yusof, and M. Nazri, "Data mining technology adoption in institutions of higher learning : A conceptual frramework incorporating technology readiness index model and technology acceptance model," *J. Appl. Sci.*, vol. 14, no. 18, 2014.

[11] C. Lin, H. Shih, and P. J. Sher, "Integrating technology readiness into technology acceptance : The TRAM model," *Phychol. Mark.*, vol. 24, 2007.

[12] M. Esen and N. Erdogmus, "Effects of technology readiness on technology acceptance in e-HRM: Mediating role of perceived usefulness," *Bilgi Ekon. ve Yonet. Derg.*, vol. IX, 2014.

[13] M. E. Putra, "Analysis of user acceptance of information systems case search on jurisdiction court of appeal in West Kalimantan," Universitas Gadjah Mada, 2014.

[14] P. Godoe and T. S. Johansen, "Understanding adoption of new technologies: Technology readiness and technology acceptance as an integrated concept," *J. Eur. Psychol. Students*, vol. 3, pp. 38–52, 2012.

[15] C. Agustina, "Android user behavior analysis in magelang with readiness and technology acceptance model (TRAM)," 2007.

[16] S. Taylor and P. A. Todd, "Understanding information technology usage: A test of competing models," *Information Systems Research*, vol. 6, no. 2. pp. 144–176, 1995.

[17] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Q.*, vol. 13, no. 3, pp. 319–340, 1989.

[18] V. Venkatesh and F. D. Davis, "Theoretical acceptance extension model : Field four studies of the technology longitudinal," *Manag. Sci.*, vol. 2, 2000.

[19] R. Walczuch, J. Lemmink, and S. Streukens, "The effect of service employees' technology readiness on technology acceptance," *Inf. Manag.*, vol. 44, no. 2, pp. 206–215, Mar. 2007.

[20] R. Martignoni and D. Mueller, "Evaluation of future mobile services based on the technology acceptance model," *ECIS 2008 Proc.*, 2008.
[21] P. M. Bentler and C.-P. Chou, "Practical issues in structural modeling," Sociol. *Methods Res.*, vol. 16, no. 78, 1987.
[22] Chomeya, "Quality of psychology test between likert scale 5 and 6 points," *J. Soc. Sci*, vol. 6, no. 3, pp. 399–403, 2010.
[23] G. Imam, *Structural Equation Modeling Metode Alternatif Using Partial Last Square PLS*, 3rd ed., Semarang: Badan Penerbit Universitas Diponegoro, 2011.
[24] J. F. Hair, C. M. Ringle, and M. Sarstedt, "PLS-SEM: Indeed a silver bullet," *J. Mark. Theory Pract.*, vol. 19, no. 2, pp. 139–151, 2011.

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