Testing of technology readiness index model based on exploratory factor analysis approach

AF Ariani¹, DNapitupulu¹, RK Jati¹, JA Kadar¹, M Syafrullah²

¹Research Center for Quality System and Testing Technology, Indonesian Institute of Sciences, Indonesia
²Program of Master of Computer Science, Universitas Budi Luhur, Indonesia

E-mails: amelia.febri@gmail.com, darwan.na70@gmail.com, rahmikj@gmail.com, jimmy.ak3@gmail.com, usurobbi85@zoho.com

Abstract. SMEs readiness in using ICT will determine the adoption of ICT in the future. This study aims to evaluate the model of technology readiness in order to apply the technology on SMEs. The model is tested to find if TRI model is relevant to measure ICT adoption, especially for SMEs in Indonesia. The research method used in this paper is survey to a group of SMEs in South Tangerang. The survey measures the readiness to adopt ICT based on four variables which is Optimism, Innovativeness, Discomfort, and Insecurity. Each variable contains several indicators to make sure the variable is measured thoroughly. The data collected through survey is analysed using factor analysis method with the help of SPSS software. The result of this study shows that TRI model gives more descendants on some indicators and variables. This result can be caused by SMEs owners’ knowledge is not homogeneous about either the technology that they are used, knowledge or the type of their business.

1. Introduction

Small and Medium Enterprises (SMEs) is now a sector of the economy that attracts public attention. In 2013, SMEs controlled 99.99% of business units in Indonesia amounting to approximately 57.8 million [1]. This amount is very big when compared with big business which only amounted to 5,066 units. In addition, SMEs plays an important role in the Indonesian economy, because SMEs are considered quite stable in the face of global economic change compared to big enterprise. This is due to the dominant source of capital and raw materials of SMEs from domestic, so it is not significantly affected if there is a change in global exchange rate or the global economic crisis [2]. This is evidenced by the contribution of SMEs to Gross Domestic Product based on current price and constant price. Figure 1 shows that the value of SMEs greater when compared with big enterprise.
Along with the increased global competitiveness in the business and business sectors, now SMEs have to improve themselves in order to have a strong competitiveness. The development of SMEShav been proclaimed by the Government of the Republic of Indonesia as stated in the Long Term Development Plan (RPJP) 2005 - 2025, as a superior economic player and has a competitive spirit [3]. In order to achieve this, it is necessary to strengthen SMEs, and one of its strengthening strategy is through the adoption of innovation and application of technology. The rate of technology application, especially information technology, is low, which is about 30 to 40% [4].

Implementation of information technology itself can be interpreted as the use of electronic technology-based systems to manage information at all business levels [5]. The positive effect of the application of information technology to SMEs is a significant performance improvement in the areas of marketing, communication, networking, and resource planning, and can improve financial and operational performance if information technology can be utilized appropriately [6]. Bruque and Moyano [7] conducted research to find out the factors that influence the application of information technology to family business and growth cooperation, including organizational growth, management role, and the establishment of new fields related to technology. Some studies discuss the successful application of information technology utilization after the technology has been adopted by SMEs, including supporting and inhibiting factors to adopt e-commerce in SMEs in Indonesia [8], measuring e-readiness for SMEs in Iran [5], adoption rate of e-trade for SMEs in Korea [9]. However, the study does not address the readiness of SMEs themselves in applying information technology.

Parasuraman [10] presents an instrument that can be used to measure an organization's readiness in applying information technology, the Technology Readiness Index (TRI). There is not much literature on TRI implementation for SMEs. Parasuraman states that this instrument can give different results when applied in different places because there are other factors that influence. Therefore, in this research, TRI will be analyzed using factor analysis method, to know its suitability in measuring readiness of SMEs to apply information technology. TRI will be analyzed by factor analysis method. This method was once used by Darmawan [11] to analyze e-Government ranking in Indonesia, validate the Nursing Student Competence Instrument (NSCI) [12], and measure the appropriateness of using Virtual Patient Adoption and Integration in Nursing (VPAIN) [13]. This research contributes to the evaluation of TRI when the method is used on different subject, in this research is SMEs.

2. Literature Review
The study conducted by Parasuraman [10], is a study that clarifies the position of users of technology. Users are the ones who have to learn more deeply to understand the technology system to be used. Correspondingly, the utility of such technology is the primary goal of the user to master the technology system [14]. Users in accepting new technology systems will experience various difficulties and ease experienced. Curiosity that generates opinions from users, users will gradually begin to understand with the service module. This opinion which will be adjusted in four factors namely Optimism, Innovativeness, Discomfort and Insecurity.
Understanding these four factors have the understanding that the optimism factor as a positive vision with the confidence of easy to master, flexible and efficient in understanding knowledge, the next factor is innovativeness with the tendency to be a pioneer / pioneer, in the use of technology, discomfort factors with the perceptions of anxiety users of technology and Insecurity is the user's perception of the insecurity of technology.

In technology readiness, the user's point of view can be grouped into five segments: explorers, pioneers, skeptics, paranoid, and sluggish [15]. This type of explorer occupies the highest score in the Contributor factor (optimism, innovativeness) and the lowest score in the dimensions of inhibitors (discomfort, insecurity). In the other hand, the sluggish type is the type that is not very interested in new technology and has the highest score in the inhibiting dimension and the lowest score in the contributors factor [15].

3. Research Methodology

This research is a survey-based quantitative research with factor analysis approach. The purpose of this factor analysis is to test the validity of the model that is model Technology Readiness Index (TRI). In this model there are variables Optimism, Innovativeness, Discomfort, Insecurity as described in research [10,15] as follows:

![Figure 2. Model Technology Readiness Index (TRI) [10,15].](image)

The data was collected by questionnaire-based survey of 107 SMEs owners in South Tangerang and surrounding areas. The distributed questionnaire consisted of 4 variables from TRI, with 34 indicators. Adequacy of data is complied with the theory of comparison of the number of samples with the number of variables (N/p) that is equal to 3/1 [17]. Data processing in this study using SPSS ranging from reliability test data questionnaire to factor analysis to test the model empirically.

Factor analysis is a unique multivariate statistic by testing the hypothesis of the correspondence between the observed value of the manifest variable [16]. Factor analysis has many uses, among others, can reduce most of the variables into a smaller set of variables as dimension reduction, estimating the underlying dimensions between measured variables and latent constructs, in other words enabling the formation and refinement of theories or hypotheses, and can provide evidence of empirical validity [18,19,20,21].

4. Result and Discussion

Factor analysis is performed after testing the reliability of the data first. The Cronbach's Alpha value obtained from the reliability test for all variables is 0.740. Meanwhile, when tested reliability for each variable Optimism, Innovativeness, Discomfort, Insecurity successively the value of Cronbach's Alpha produced is 0.771; 0.539; 0.658; and 0.738. Arikunto (2013) mentions that when the value of Cronbach's Alpha produced is more than 0.6 then the data has a high degree of reliability, while for values between 0.4 to 0.6 has a moderate degree of reliability [22, 23]. Based on this, then the data is said to be reliable, so that can be done further analysis.

4.1. Variable Optimism
There are nine indicators in the variable of Optimism. Prior to further analysis, the indicators were analyzed to determine their significance through measurement of Kaiser-Meyer-Olkin (KMO) and Bartlett's Test values. The KMO measurement value for the indicator in the Optimism variable is 0.693, where the value is > 0.5 [24]. The significance value based on Bartlett's Test is 0.000, is <0.05 [25]. Therefore, the data for these variables is feasible for further analysis. After that, each indicator is analyzed correlation with each other in the form of value of Measures of Sampling Adequacy (MSA). The MSA value for each indicator in this Optimism variable is > 0.5, so it can be concluded that each indicator correlates to another indicator. Therefore, the indicators can be analyzed further to find out the number of factors formed by looking at the value of eigenvalues > 1. The result obtained that there are 3 factors that have formed eigenvalues value more than 1, ie 3.283; 1.507; and 1.026.

To know the indicators that can be grouped on certain variables can be seen in loading factor data contained in Table 1. If loading factor > 0.5 is considered very significant, loading factor > 0.4 is more important, and loading factor > 0.3 is significant.

**Table 1.** Rotated component matrix variabel optimism.

| Component | 1  | 2  | 3  |
|-----------|----|----|----|
| OP1       | 0.145 | 0.057 | 0.920 |
| OP2       | 0.213 | 0.327 | 0.769 |
| OP3       | 0.244 | 0.728 | -0.078 |
| OP4       | 0.066 | 0.671 | 0.259 |
| OP5       | 0.674 | 0.090 | 0.269 |
| OP6       | 0.851 | -0.180 | 0.061 |
| OP7       | 0.717 | 0.235 | 0.069 |
| OP8       | 0.699 | 0.409 | 0.072 |
| OP9       | -0.039 | 0.634 | 0.386 |

Therefore, the grouping of indicators into factors based on the loading factor is as follows:

- Factor 1: OP5, OP6, OP7, OP8
- Factor 2: OP3, OP4, OP9
- Factor 3: OP1, OP2

4.2. Variable Innovativeness

In Innovativeness variables there are seven indicators, with Kaiser-Meyer-Olkin measurement value of 0.653, where the value is > 0.5. The significance value based on Bartlett's Test is 0.000, is <0.05. Therefore, the data for these variables is feasible for further analysis. When analyzed to determine the MSA value of each indicator, it appears that the INO2 indicator has a value of 0.398 where the value is <0.5, so the INO2 indicator has no significant correlation with other indicators and the indicator is not done further analysis. After INO2 is deleted and re-analyzed to determine the MSA value, all indicators have a value > 0.5.

Based on the value of eigenvalues, the result obtained are two factors that can be formed because it has eigenvalues value > 1, that is equal to 2.173 and 1.055. Table 2 showed the loading factor data so that the indicators can be grouped into two factors as follows:

- Factor 1: INO5, INO6, INO7
• Factor 2: INO1, INO3, INO4
The results of the analysis also showed that seven indicators (INO 1-INO 9) cannot be used to represent Inovativeness variables, as two factors can still be formed. Factor 1 can be said as a challenge factor that represents that the latest technology requires an effort to follow it, while factor 2 (leader) reflects that user leadership in using technology. In addition, at the time of the MSA value analysis it was found that the INO2 indicator was not correlated with other indicators so it was not continued in the factor analysis.

| Table 2. Rotated component matrix variabel innovativeness. |
|----------------------------------------------------------------|
| Component | 1 | 2 |
| INO1 | .381 | .438 |
| INO3 | .212 | .571 |
| INO4 | -.111 | .859 |
| INO5 | .723 | .249 |
| INO6 | .566 | .467 |
| INO7 | .797 | -.103 |

4.3. Variable Discomfort
In the Discomfort variable there are nine indicators, with Kaiser-Meyer-Olkin measurement value of 0.636, where the value is> 0.5. The significance value based on Bartlett's Test is 0.000, is <0.05. Therefore, the data for these variables is feasible for further analysis. The measurement of the MSA value for all indicators in the Discomfort variable is entirely> 0.5, so that each indicator correlates to the other indicators and can be further analyzed. The result obtained according to eigenvalues are 3 factors that are formed because it has eigenvalues more than 1, that is 2.458; 1.233; and 1.139.

| Table 3. Rotated component matrix variabel discomfort. |
|-------------------------------------------------------|
| Component |
| 1 | 2 | 3 |
| DIS1 | .199 | -.155 | .820 |
| DIS2 | .401 | .223 | .523 |
| **DIS3** | **-260** | **.569** | **.594** |
| DIS4 | .234 | .704 | -.260 |
| DIS5 | .096 | .720 | .142 |
| DIS6 | .434 | .392 | .138 |
| DIS7 | .619 | -.030 | .028 |
| DIS8 | .603 | .064 | .268 |
| DIS9 | .668 | .260 | .001 |

Based on the data in Table 3, there is a cross loading on the DIS3 variable. Cross loading is a condition where on one indicator there is a loading factor value that has the same high value on two or more of all the factors formed. If such things happen, what can be done is to manipulate the number of factors that are formed. If the previous factors formed a number of three factors, then the next determined by two factors to be formed. Table 4 shows that there is no indicator that has
crossloadvalue after determined two factors to be formed, so it can be known the division of indicators
in Discomfort variable into the following factors:

- Factor 1: DIS1, DIS2, DIS3, DIS7, DIS8
- Factor 2: DIS4, DIS5, DIS6, DIS9

**Table 4. Rotated component matrix variabel discomfort (2 Factor).**

| Component | 1   | 2   |
|-----------|-----|-----|
| DIS1      | .789| -.292|
| DIS2      | .664| .200 |
| DIS3      | .369| .246 |
| DIS4      | -.065| .783|
| DIS5      | .194| .636 |
| DIS6      | .367| .469 |
| DIS7      | .364| .193 |
| DIS8      | .558| .204 |
| DIS9      | .378| .476 |

Based on the results of factor analysis, it can be seen that nine indicators (DIS1-DIS9) can not be
used to represent one variable that is Discomfort, because after analyzed two factors formed.
Factor 1 can be said as a pessimism factor that reflects the use of technology can not be directly
understood and contains risks in its use. Meanwhile, factor 2 (prejudice) reflects the distrust of the user
when utilizing the technology.

4.4. Variable Insecurity

In the Insecurity variable there are nine indicators, with Kaiser-Meyer-Olkin measurement value of
0.653, where the value is> 0.5. The significance value based on Bartlett's Test is 0.000, is <0.05.
Therefore, the data for that variable is feasible for further analysis. The MSA value generated by each
indicator is> 0.5 so each indicator correlates to the other indicators and can be further analyzed.
Based on the value of eigenvalues obtained, it is known that the resulting three factors because it has
eigenvalues value>1, that is 3.019; 1.718; and 1.075.

**Table 5. Rotated component matrix variabel insecurity.**

| Component | 1   | 2   | 3   |
|-----------|-----|-----|-----|
| INS1      | .782| -.131| .214|
| INS2      | .775| .337| -.115|
| INS3      | .838| .180| .042|
| INS4      | .502| .696| .117|
| INS5      | .106| .494| .229|
| INS6      | .085| .268| .677|
| INS7      | -.304| .331| .724|
Based on the loading factor value in Table 5, it can be seen dividing indicator of Insecurity variable into two factors as follows:

- Factor 1: INS1, INS2, INS3
- Factor 2: INS4, INS5, INS9
- Factor 3: INS6, INS7, INS8

Based on the results of the analysis, nine indicators on Insecurity variables can not be used to represent these variables because after the analysis can form three factors. Based on the description of the indicator in Table 1, it can be said that factor 1 is insecurity, reflecting the potential leakage of confidential information provided with the mediation of technology. Meanwhile, factor 2 (distrust) is the user does not believe fully that the information conveyed through the technology can be up and properly understood by the next party. Factor 3 can be said to be an interaction factor that reflects the user's need to stay in touch with humans, even if they have used technology.

5. Conclusion

Based on the test result of TRI model validation, it can be concluded that the model is irrelevant to be used on the study case of SMEs in South Tangerang. This can be shown in the findings for nine indicators of optimism can not be used to represent one variable that is Optimism, because after the analysis formed three factors. It is also applied on other three variables. For Innovativeness, the variable can create two factors, Discomfort form two factors and Insecurity form three factors. This result can be caused by SMEs owners’ knowledge is not homogeneous about the technology that they are used, knowledge, the type of their business, etc. Therefore, the suggestion for the next research is to test the TRI model by increasing the number of samples and compare with the SMEs in other areas. Besides, this research can also be combined with qualitative approach or observation in order to see the effect of knowledge level of the owners, SMEs infrastructure availability, and SMEs business type.

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