Determinants of Information and Communication Technology (ICT) Adoption: A Study of Indonesian Small and Medium Enterprises (SMES)

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Abstract - *The existence of SMEs has been a great help for economic development considering its contribution to GDP and employment rate, particularly in developing countries including Indonesia. Through the Ministry of Cooperatives and SMEs, The government of Indonesia designed several programs to increase the number of SMEs in Indonesia every year. As the number of SMEs is rising, the level of competition among them is increasing as well. However, the advent of high-tech era makes literacy and implementation of ICT become an important factor in determining whether SME can exist, grow, and survive. Unfortunately, the fact shows that the current condition in Indonesia is still far from the expectation regarding how importance is ICT to be adopted by SMEs. Thus by implementing Path Analysis as part of Structural Equation Modeling method, this study aims to find out the key drivers of ICT adoption in Indonesian SMEs. The study was conducted by distributing questionnaires to 150 SMEs with different background and sectors from all over Indonesia. The obtained data is analyzed using XLSTAT, IBM SPSS Statistics, and IBM SPSS AMOS. As a result, the analysis shows that environmental factor is the strongest factor which lead Indonesian SMEs to adopt information and communication technology (ICT).*

Key Words: ICT adoption, SMEs, Path Analysis, TOE framework, Indonesia

1. INTRODUCTION

Considered from several point of views, the existence of SMEs is a great blessing for an economic development both in developing and developed countries. It has an important contribution in increasing national GDP of majority countries and motivates developing countries to empower their local resources [1,2]. However, although the emergence of SMEs has lasted a long time and followed by immense achievement, the government just show its support in recent times [3]. Additionally, [4] stated that Ministry of Cooperatives and Small Medium Enterprise in 2011 reported there are around 99,99% of Indonesian Business consists of SMEs. While, at the same time, the Central Bureau of Statistic clarified that SMEs committed significantly around 60% to the GDP and absorbed approximately 97% of the total workers [5]. Chart-1 and Chart-2 depicted the latest report released by the Ministry of Industry of Indonesia [6] who mentioned that workforce and the number of SMEs itself has continued to increase gradually from 2014 to 2017. The number keep growing and increasing the level of competition among SMEs. In other words, SMEs are

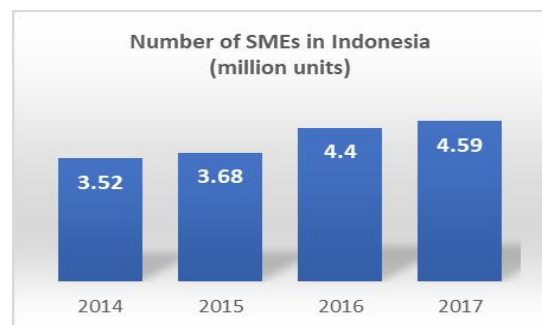experiencing more severe challenges in maintaining and expanding their business.

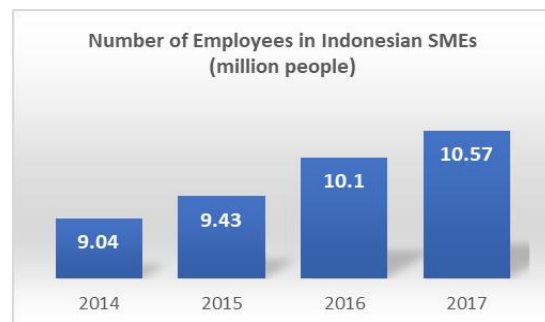**Chart -1**: Number of SMEs in Indonesia

Chart -2: Number of SMEs in Indonesia

On the other hand, challenges also come from the rapid progress and development of technology. In this case, the information and communication technology (ICT). [7] mentioned that ICT dispersion caused rapid changes in industries and business environments. From the company's point of view, ICTs may bring significant changes in businesses internal processes, firm's structure, organization and also its operations [8]. In addition to various changes from the internal of the company, several changes also occur in the downstream of a business, that is the customer. [9] added that technological developments have an impact in increasing demand for customized products. Customers tend to make a request and include personalized value in the products that they are willing to buy. In order to smoothing the customization, technology is the only option that company has [9,10]. By this condition, the role of ICT today is no longer just a technological tool to improve the efficiency of internal processes, but also a source to achieve competitive advantage [11]. Moreover, in a more general

context [12] stated that adoption and the effectiveness utilization of ICT significantly affects both of the economic growth and operational efficiency in private and public institutions. Therefore, adopting new technologies such as ICT is becoming inevitable for companies, including SMEs, in order to survive and grow in this new business environment. As it was said by Jerry Jasinowski, President of the US National Association of Manufacturers, in the Wall Street Journal that small enterprises should be able to adapt and adopt the concept of e-commerce if they do not want to be displaced from marketplace competition [13].

1.1 Problem Statement

Based on the data on [14], it is revealed there were only 20% of Indonesian SMEs that already adopted ICT. This fact is far from the expectation regarding how importance is ICT to be adopted by SMEs. Moreover, this condition might occur an adverse impact on SMEs' sustainability and growth which may also be followed by economic downturns, particularly the GDP. Therefore, the first urgency of this study is aimed to analyze the variables that could positively boost the adoption of ICT among SMEs.

Actually, there are prior researches aimed for the betterment of SMEs. However, those studies have limited its focus on the determinants of ICT adoption in Indonesian SMEs, particularly the research comprising young SMEs which have been operating for less than 3 years. In addition, the used of relevant theoretical framework in related study are still rare. Whereas, the analysis of ICT adoption factors and its impacts on company performance are important in order to understand how to stimulate SME during the process of investment in new technologies so they can acquire competitive advantages and good business performances. Furthermore, it is also vital to develop a proper condition that able to effectively encourages the rest of SMEs to adopt new technologies.

1.2 Research Objectives

Based on the background and problem statement, this study aimed to see the relationship between variables of ICT adoption under TOE framework. Furthermore, the output is designed to see the impacts of ICT adoption towards SMEs' performance both in financial and non-financial factors. Not to mention, this study employs Path Analysis Model since the framework is based on variables relationship.

2. THEORETICAL BACKGROUND AND HYPOTHESES

Basically, there are several theories related to ICT adoption such as Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Diffusion of Innovation Theory (DOI), and Technological, Organizational and Environmental Framework TOE). According to TRA framework, [15] claimed that there are two factors that lead to individual's intention to perform an action. A major

assumption of TRA which later was criticized by [16] is that the most human social behavior is under volitional control, so the theory cannot be implemented in the opposite situation. To overcome this weakness, [16] proposed a new theory by adding a construct named Perceived Behavioral Control (PBC) to the TRA model which later was named Theory of Planned Behavior (TPB). However, this theory is still not able to overcome the conditions where intention and behavior has a very high correlation that can lead to weak predictive power of the model. Then Technology-Organization-Environment (TOE) framework was introduced with aims to explain the impact of contextual factors in innovation adoption. It consists of technological context, organizational context, and environmental context that drive technology adoption.

From the theories above, this study employed TOE by considering the context and purpose of this research and comprising with [17] postulate. [17] stated that the study related to technology adoption drivers can be classified into three subjects: (1) Intention-based models relying on whether users accept and then use technology; (2) diffusion innovation which put the concern on the reason and the process of new technology dispersion around organization; and (3) how the new technology affects the goal, objective and performance of organization. Since this study is designed to involve the first stream of [17] classification, this research propose TOE framework. Thus, the hypothetical model in this research are proposed in Fig-1.
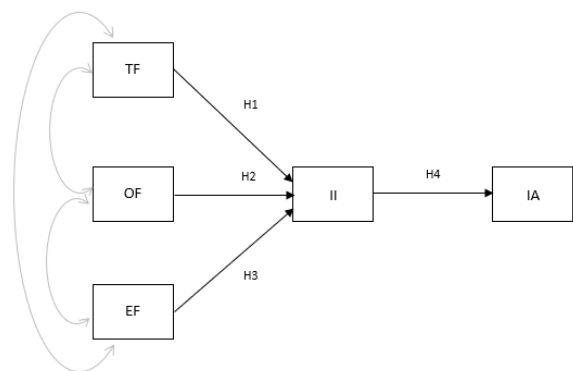
Fig -1: Hypothetical framework of ICT adoption in Indonesian SMEs

H1: Technological factor (TF) positively affect ICT Intention (II) in Indonesian SMEs

H2: Organizational factor (OF) positively affect ICT Intention (II) in Indonesian SMEs

H3: Environmental factor (EF) positively affect ICT Intention (II) in Indonesian SMEs

H4: ICT intention (II) positively affects ICT Adoption (IA)

3. METHODOLOGY

3.1 Sample and Data Collection

For the data collection, 150 printed questionnaires which contains 16 questions with 5-point likert-scale were distributed to participants of "*Inovator Inovasi Indonesia Expo*". All participants are small and business enterprises from various sectors such as food, health and medicine, information and communication technology, energy, advanced material, transportation, and public safety and security around Indonesia.

3.2 Participants

83 questionnaires were returned and processed using XLSTAT to sort and eliminate the missing data. After the process, there were only 20 usable data that later are analysed using Path Analysis method in IBM SPSS AMOS. The demographic of participant's location, sector, operating period, and number of employees are given in Table-1.

Table-1: Participants demographic features

Variable	n(%)
City	
Surabaya	4 (20%)
Banyuwangi	1 (5%)
Lampung Selatan	2 (10%)
Bogor	5 (25%)
Yogyakarta	2 (10%)
Tangerang Selatan	1 (5%)
Jember	1 (5%)
Denpasar	2 (10%)
Padang	1 (5%)
Wonosobo	1 (5%)
Sector	
Food	12 (60%)
Health and medicine	2 (10%)
Information and Communication Technology	3 (15%)
Energy	1 (5%)
Advanced material	1 (5%)
Transportation	1 (5%)
Public safety and security	0 (0%)
Age / Operating period	
0 year < age ≤ 1 year	10 (50%)
1 year < age ≤ 2 years	6 (30%)
2 years < age ≤ 3 years	4 (20%)
Number of employees	
Number of employees ≤ 5	16 (80%)
5 < Number of employees ≤ 10	4 (20%)
10 < Number of employees	0 (0%)

According to Table-1 the participants are dominated by SMEs located in Bogor (25%) and Surabaya (20%). This is a surprising fact reminding the event ("*Inovator Inovasi Indonesia Expo*") was held in Surabaya, but the participants who came from other cities are greater than the local participants. While in terms of sectors, most of the participants are SMEs that engaged in the food sector with a percentage of 60%, followed by ICT and health and medicine, respectively 15% and 10%. Moreover, 50% of the total participants has run their business for less than or equal to one year, while 30% are over one year but less than or equal to two years, and the rest are more than two years but less than three years. Based on the number of employees, 80% of participants are SMEs with less than or equal to five employees, while the rest are SMEs with five to ten employees and none of them has more than ten employees.

3.3 Measurement

The measurement of technological factor in this study focusing on three things, those are existing technology infrastructure which is adapted from [18], compatibility, and innovation barriers. While organizational factor was measured through visionary leadership which adapted from [7] and and ICT awareness. The environmental factor which is describe external influences in this research was measured through externalities pressure [19] and externalities supports [20], and competitiveness. Then the ICT intention was measured through the willingness of SME in adopting ICT, while the ICT adoption was measured by number of technology that have been used by SME. The more detail explanation of the indicator for each variable are listed in Table-2.

Table-2: List of indicators for each variables

| Variable	Indicator	Measurement
TF	Existing technology infrastructure	
	Compatibility	
	Innovation barriers	
OF	ICT awareness	5 points likert-scale
	Company's vision	
	Company's mission	
EF	Competitiveness	1= Definitely Agree
	Pressure from Competitor	
	Support from investor	2= Agree
	Support from local government	3= Neutral
II	ICT intention in RnD	4= Do not Agree
	ICT intention in production	5= Definitely do not agree
	ICT intention in marketing	
IA	ICT adoption in RnD	
	ICT adoption in production	
	ICT adoption in marketing	

4. DATA ANALYSIS AND RESULTS

4.1 Validity and Reliability Testing

Before analyzing the path relationship, validity and reliability testing were conducted using IBM SPSS Statistics to ensure that all indicators of each variables measure the same thing and produce consistent results. The testing process is performed by calculating the Pearson Correlation value for validity and Cronbach alpha for reliability. An indicator is considered valid if the value of Pearson Correlation is bigger than value of r table product moment. For instance, if there are 20 data and the desired significance is 0.05 so the r table is 0.444 and for 20 data with significance level of 0.01 the r table is 0.561. Meanwhile, reliability can be claimed if the value of Cronbach alpha is bigger than equal to 0.6. Based on these two values, all indicators used in this study are valid and reliable, except the technological factor which the generated cronbach alpha is 0.58. Following the rule that was mentioned previously, it is

classified as questionable but not too poor. Appendix A shows more details of this validity and reliability testing.

4.2 Path Analysis Results
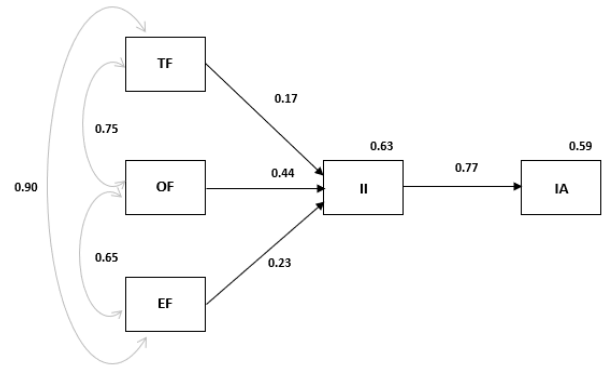
Fig -2: Path analysis result of ICT adoption in Indonesian SMEs

The path analysis results based on the total scores obtained from data collection tools are depicted in Fig. 2. According to these results, all paths are positively correlated. Among 3 factors, the path between organizational factor and ICT intention yielded the highest coefficient (r = 0.44; p-value <0.001). By this result we can easily say that H2 is accepted. Similarly, H1 also accepted even with such a low path coefficient (r = 0.17; p-value <0.001). However, H3 is also accepted since it shows positive correlation between external factor and ICT intention (r=0.23; p-value<0.001). The number 0.63 shows coefficient of determination (R^2) of ICT intention which means 63% of the variance can be explained in the model. Thus 37% of the share variance are not included in the scale. Finally, H4 also accepted since the ICT intention and ICT adoption were positively correlated (r = 0.77; p-value <0.001) with R^2 = 0.59 for ICT adoption. Fortunately, the model fit test of the scale was found to be extremely high (CFI = 0.977, NFI = 0.948) where the cut off for CFI and NFI is between 0.8 and 1. In conclusion, Table-3 shows the fulfillment of the hypotheses in this study.

Table-3: Results of tested hypotheses

Variable	Hypotheses	Result
TF --> II	Technological factor positively affect ICT intention in Indonesian SMEs	Accepted (+)
OF --> II	Organizational factor positively affect ICT intention in Indonesian SMEs	Accepted (+)
EF --> II	Environmental factor positively affect ICT intention in Indonesian SMEs	Accepted (+)
II --> IA	ICT Intention positively affect ICT adoption in Indonesian SMEs	Accepted (+)

5. CONCLUSION

This study shows that Path Analysis Model can accommodate the investigation of relationship between variables in this study. It indicates that the acceptance of hypotheses became clearer after the analysis conducted. Elaborately, from the analysis this study conclude that the key driver of ICT adoption is organizational factor which measured by ICT awareness and visionary leadership. However, the small sample size and the low score of R^2 of both ICT intention and ICT adoption made this study need to be further investigated either by collecting more data or explore more variable to be included within the framework.

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