Technology Contribution Assessment using *Technology Contribution Coefficient* (TCC) at Small and Medium-sized Enterprises in Semarang, Indonesia

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Abstract. Small and Medium-sized Enterprises (SMEs) has a rapid growth nowaday in Indonesia Statics showed that the growth of SMEs in 2011 and 2012 were 2.57% and 2.41%. However, the growth of SMEs was not accompanied with capability and readiness to enter local or global competition. It can be seen that product from SMEs less compete with the product of other countries.This research aims to know the readiness of SMEs in Semarang in confronting Asean Economic Community (AEC) by using E-commerce. Technology Contribution Coefficient (TCC) was used to evaluate and assessed the contribution of technology The evaluated component was consisted of technoware, humanware, infoware, and orgaware. Based on data analysis, the highest contribution was humanware highest (H=0.598), then infoware (I=0.569), then technoware (T=0.479) and orgaware (O=0.440) respectively. It was known that the company's TCC value is 0.542. The value of TCC is between 0.3 and 0.7 which infered that the technological level is semi-modern. SMEs in Semarang has not ready yet to confront AEC. Based on this technology assessment, it is suggested that in short term, the company should focus their resources to strengthen the capability of technoware and infoware. While in long term, control the attenuation of the company can be focused on orgaware.

Keywords: *SMEs, E-commerce, Technoware, Infoware, Humanware, Orgaware, TCC*

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INTRODUCTION

Asean Economic Community (AEC) begins to be applied in early 2015. AEC is a project that has long been prepared by all members of ASEAN which aims to improve the economic stability in the ASEAN region and build the strong economic area among ASEAN countries. This caused the residents in ASEAN countries can easily and freely choose the location of the job they want. From the investment side, the AEC will support the entry of foreign investors to stimulate economic growth. In terms of employment, investment growth will also have the potential to increase the number of jobs in the country.

One of Indonesia's ways to build its economy sector is by adding SMEs sector [1] The Central Statistics Agency (BPS) in 2013 said that the number of business units in Indonesia consists of: micro-enterprises as much as 57,189,393 units, : micro-enterprises as many as 57,189,393 units, as many as 654,222 units of small businesses and medium-sized businesses as many as 52,106 units, while the large business unit amounted only 5,066 units. Thus SMEs constitute the largest businesses (99, 9%) than large enterprises which is only 0.1% of the total existing business unit in Indonesia. BPS data from 2012 shows that the contribution of SMEs to Indonesia's (Gross Domestic Product) GDP in 2011 amounted to 56.6%, and absorbing 97% of the national workforce. SMEs also contribute to the increase of foreign exchange in the form of export receipts which is amounted to 27,700 billion and create 4.86% of the total exports [2]. The contribution of SMEs to national revenue is much smaller than the contribution of big businesses, so that SMEs is more empowered. SMEs also play a role in the formation of national investment. The SMEs investment experiencing increasement from time to time during the period 2000 - 2011. According to the statistical report SMEs in various editions between 2000-2011, it is known that in 2000 SMEs investment of Rp 133.08 trillion and increase to Rp 275.27 trillion in 2005. In addition, SMEs also contributes to the income equalization efforts of Indonesian people. The existence of SMEs may increase the economic capacity of society that is engaged in the SMEs sector both as business owners and as employeers [3].

Many SMEs are already aware of this. But many have not aware yet. The role of SMEs is very large as a locomotive for economic growth triggered by the level of consumptive society [4]. The readiness of SMEs in Indonesia, especially in Semarang city is still in a question. Rapid technological developments make one of the triggers successful in a business Efforts to increase value added can be done through the use of technology in every business activity, so the competitive advantage of the company can be formed by creating excellence in one or several chain business activities [5]. Therefore, companies with business strategy based on technological capabilities will be able to compete in the competitive business world [6]. The increase in production value added can be achieved by increasing the scale of production and increasing the use of technology [7]. Technometric term is used in some analysis to show measurement of technology aspects [8]. Forth basic components those are technoware, humanware inforware and orgaware change input into output with different variety and complexity. Those fourth basic components are complementary each other and simultaneously needed in each process of transformation [9]. Technometric model is used to measure contribution combination of those four technology components.Result gained from using of this model is Technology Contribution Coefficient (TCC). Factors that affect the technology are technoware, humanware, infoware, and orgaware [10]. To determine the level of technology that used by SMEs in Semarang is necessary to measure the contribution of technology using Technology Contribution Coefficient (TCC).

This research will assess adoption of technology, human resource, and information and management of organization. Modeling SMEs in Semarang using technometric approach to gain description about opportunity of SMEs in conforting AEC. Model gained could be contribution form of strategy to accelerate adoption of technology in order to resulting product with high competitiveness in Technoware, Inforware, Humanware and Orgaware.

RESEARCH METHODS

This research is a descriptive study. This research use questionnaire, observation and interview. This research ,performed at Small and Medium-sized Enterprise in Semarang. Technological content analysis carried out on the SMEs and was measured using a model technometric [11]. Technometric model defines the coefficient contribution of technology (TCC). Technometric model has four components ; Technoware, Humanware, Infoware, and Orgaware. Data needed in this research are taken by methods :

1). Observation, Interview and Questionnaire about object of research to collecting primary data and other related data that are needed.
2). Literature Study to collecting data from some related references.

The steps to define TCC's score are :

1). Tabulation of Data
2). Estimation of the degree of sophistication of the technology with the scoring method. The estimation results provide an upper limit (UL) and lower limit (LL) the degree of sophistication of each technology component.
3). Assessment of State of The Art each technology component.

To determine assessment criteria each component and evaluate it. Rating of State of the art each component using the formula:

Technoware : $ST_i = 1/10\ [\Sigma t_{ik}/k_t]$; k= 1,2,3,…,k_i (1)
Humanware: $SH_j = 1/10\ [\Sigma h_{il}/l_h]$; l= 1,2,3,…,l_j (2)
Infoware: $SI = 1/10\ [\Sigma f_m/m_j]$; m= 1,2,3,…,m_f (3)
Orgaware: $SO = 1/10\ [\Sigma o_n/n_o]$; n= 1,2,3,…,n_o (4)

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4). Determination of the valuation of the contribution of each component

The valuation of the contribution of each component is calculated from the value limits the degree of sophistication and value of the state of the art using the formula:

Technoware: $T = 1/9 [LT+STi(UT-LT)]$ (5)
Humanware: $H = 1/9 [LH+SHj(UH-LH)]$ (6)
Infoware: $I = 1/9 [LI+SI(UI-LI)]$ (7)
Orgaware: $O = 1/9 [LO+SO(UO-LO)]$ (8)

5). Determination of the intensity contribution of each component technology.

It uses a pairwise comparison matrix approach. The purpose of the determination of the intensity contribution of technology component that is to get the value of the interest rate scale technology components (β).

6). Assessment of the contribution of technology.

Assessment of the contribution of technology based on Formula off Technology Contribution Coefficient (TCC):

$$TCC = T\ \beta^t \times T\ \beta^h \times T\ \beta^i \times T\ \beta^o \quad (9)$$

TCC value describes the magnitude of the contribution technology in creating added value in the object. TCC value has a value range between 0 and 1. TCC value is assessing level technology of a company. According to Wiratmaja and Ma'ruft, If the value less than 0.3, so level technology of the company be on a traditional level . If TCC value between 0.3 and 0.7 , level technology of company be on a semi modern level and be on a modern level if TCC value more than 0,7 [12] .

C. RESULT AND DISCUSSION

1. Analysis of Technology Contributions Assessment

The technology assessment at SMEs in Semarang can calculate using a technometric model. A technometric model based on the value of each technology component criterias. The value use scoring method (score 1-9) based on a subjective assessment. The technology component criterias are technoware, humanware, infoware and orgaware.

a. Determination of Estimated Degree of Sophistication

The upper and lower limit of the degree of sophistication is found in each component of existing technology in SMEs. The value of the limit can be seen in table 1. In general, humanware component on SMEs is in the ability of various types of employees. Humanware component lower limit score is 2 in all criterias and an upper limit score is IT capability (score 8) and production capability (score 9). For Infoware component, the criteria can be seen from information flow that occurs within the SMEs. Infoware component has a lower limit (score 1-3) and an upper limit (score 6-8) with the lowest score in demand supplier, distributor information collecting method due to many SMEs still use the manual device and the highest score when product achieving because many SMEs has ways to achieving products. For technoware component, based on the technology used, manual, semi-automatic and automatic, with a lower limit (score 1-3) which score 2 for supply order method criteria and score 3 for sell transaction methods criteria. The upper limit of Technoware within 6 (production equipment) and 9 (supporting facilities). For orgaware component, the criteria can be seen through existing organizational structure in the SMEs to the lower limit within 1 (organization criteria) and 2 (information flow and management) and the upper limit within 6 (organization) and 8 (information flow).

b. Calculation of state of the art technology components

State of The Art value obtained using the formula (1), (2), (3) , (4). State of the art of the technology component of SMEs in Semarang can be seen in Table 1.

Table 1 Table 1. State of Art of TCC

Technology Component	Degree of Sophistication		State of the art
	Lower Limit	Upper Limit	
Humanware			
Production Capability (H1)	2	9	0.5167
IT Capability (H2)	2	8	0.45
Sales & Marketing Capability (H3)	2	9	0.4967
Infoware			
Demand, Supplier,Distributor Information Collecting Method (I1)	1	6	0.3467
Product Marketing (I2)	2	8	0.4967
Product Selling Method (I3)	3	8	0.5067
Product Achieving Method (I4)	3	9	0.55
Feedback (I5)	1	8	0.4167
Technoware			
Supply Order Method (T1)	2	7	0.4433
Transaction with Supplier Method (T2)	1	8	0.44
Production Equipment (T3)	1	6	0.39
Supporting Facilities (T4)	1	9	0.4567
Sell Transaction Method (T5)	3	8	0.46
Inventory System (T6)	1	7	0.34
Orgaware			
Information Flow (O1)	2	8	0.4633

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Infoware			
Demand, Supplier,Distributor Information Collecting Method (I1)	1	6	0.3467
Product Marketing (I2)	2	8	0.4967
Product Selling Method (I3)	3	8	0.5067
Organization (O2)	1	6	0.2933
Management (O3)	2	7	0.3233

The State of the Art value of each component is a portrait of the component's position of SMEs. Humanware components are influenced by educational background and the ability of employees to maintain production, IT sales and marketing process, creativity and innovation when resolving problems and the SMEs awareness.

c. Contributions Component Technology

The result calculated contribution of each component technology can be seen in Table 2.

Table 2 Table 2. Summary of Contributions Component Technology

Technology Component	Contribution Component	Intensity Contibution Technology(β)
Humanware	0.5975	0.462
Infoware	0.5686	0.210
Technoware	0.4792	0.164
Orgaware	0.4399	0.164

The lowest value contribution component is orgaware (0,4399) due to the organizational structure that slight attenuation of each SMEs and still in the form of small business organizations, but was able to increase the capability of SMEs, while the highest score is on humanware component (0,59740) due to SMEs in Semarang still rely on the ability of employees in the process.

d. Determination of intensity Contributions Technology (β)

The value of β can be seen in Table 2. The intensity values for each component is valued from each resource at each SMEs. In the assessment results obtained that humanware component has the highest intensity value (0.462) and the value of the lowest intensity is on the technoware and orgaware component (0.164). The intensity of infoware component is 0.21. The intensity value of each component according to the experts and practitioners as follows: $\beta h > \beta i > \beta o = \beta t$. Based on the calculation consistensy ratio of 0.1 indicates that the assessment of the level of importance that has consistently performed because the value of ≤ 0.1. The highest intensity for humanware show the the ability of employees is a major component in SMEs. In the last place ,there are technoware and orgaware component. So , they have a bit influence for SMEs.

e Calculation of Technology Contribution Coefficient (TCC)

Based on the results of the calculation of formula (9), The TCC value of SMEs in Semarang is 0.5424. It shows that level of technology is semi modern level. According Hafids (2002), the results of the calculation of contributions TCC can explain the contributions made in the technology value -added of a product and also the application of technology in the production processes . The result of this calculation can be used as a consideration for decision making.

CONCLUSION

The result of TCC score in Small and Medium-sized Enterprises (SMEs) in Semarang is 0.5424, the technology component criterias are technoware, humanware, infoware and orgaware. The value of TCC is a portrait that the level of technology in SMEs in Semarang based on a qualitative and quantitative assessment of TCC interval are in good classification and based on the level of technology is at the level of semi-modern technology. So, SMEs in Semarang are not ready to confront AEC. It is because SMEs in Semarang rely on humanware or the ability of employees, while organaware and technoware can be showed from organization structure and facility uzilitation.

Suggestions provided on the results of this study are: in the short term, the company should focus their resources to strengthen the capability of technoware and infoware component. While in long term, control the attenuation of the company can be focused on orgawareorgaware.so that the level of technology can be increased. For further research is to enlarge the scope of SMEs such the region so the research more complex.

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