Mapping Requirements into E-commerce Adoption Level: A Case Study Indonesia SMEs

Evi Triandini[13], Arif Djunaidy[2], Daniel Siahaan[1]
[1]Department of Informatics, Institut Teknologi Sepuluh Nopember, Indonesia
[2]Department of Information Systems, Institut Teknologi Sepuluh Nopember, Indonesia
[3]Department of Computer Systems, STMIK STIKOM Bali, Indonesia
evi.triandini11@gmail.com, adjunaidy@is.its.ac.id, daniel@if.its.ac.id

***Abstract*—Requirements engineering provide an appropriate mechanism for understanding what the customer wants. Small and Medium Enterprises (SMEs) need to improve their ability to face a global market. This study proposed a framework of e-commerce adoption that provided functional requirements of each level. Mapping of functional requirements into level was identified using The Delphi method. The questionnaires were distributed to academicians, researchers and information technology practitioners. The questionnaires were sent to 15 respondents. This framework can be used as a guideline for SMEs in order to implement e-commerce. The future work would be evaluating the e-commerce adoption framework on larger number of SME's in Indonesia**

Keywords—SMEs; requirements e-commerce; e-commerce adoption level

I. INTRODUCTION

In global market, Small and Medium Enterprises (SMEs) need to improve their ability to respond to the market changes. E-commerce recommend opportunities and potential benefits to the SMEs [1]. Small and Medium enterprises (SMEs) in Indonesia decreased the rate of poverty and unemployment. However, Indonesia SMEs are still reluctant in adopting e-commerce. Hafied [2] noted that an adoption among SMEs in Indonesia is still very low, although they have started to apply e-commerce to maintain their business process. The previous study investigated a problem in e-commerce adoption such as difficulty to expand activities related with implementation e-commerce in their company [3].

The previous research by Rao and Metts [4] presents a maturity model of e-commerce adoption based on the features of the evolutionary nature of e-commerce. The research by Govindaraju and Chandra [5] also recommends a maturity model of e-commerce adoption based on the Rao. Both models does not have components that can be used to determine the use of website facilities provided by a e-commerce application. In order to overcome this problem, a framework is needed as a guideline for SMEs in implementing e-commerce. Among other things, this framework will provide a measurement that can imitate the level of e-commerce adoption by SME. An existing framework was identified based on developer- oriented. It was not suitable with a stakeholder's concern of SMEs, such as system owner and system end-user. To overcome this problem, this study proposes a framework of e-commerce adoption consisting of level and functional requirements. This study is part of a bigger research. The objective of this study is to map requirements of e-commerce application into level of e-commerce adoption, case study at Indonesia SMEs. This framework can be used as a guideline for IT practitioners to develop e-commerce that is suitable for SMEs. This framework is also useful for SMEs as a guideline implementing e-commerce in order to achieve the higher level of adoption.

The rest of this paper is organized as follows. A summary of the literature review on requirements of e-commerce application, e-commerce adoption in SMEs and Delphi method are first presented. Then the research methodology is described. Next, result and analysis of the data processing is discussed. Finally, conclusion and further research are outlined.

II. LITERATURE REVIEW

A. Requirements in E-commerce Application

Requirements engineering present the appropriate mechanism for understanding what the customer needs. Based on functional requirements, they can be classified into: (a) functional requirements which describe systems functionalities or services; (b) non-functional requirements, which describe systems properties and constraints [6]. Functionalities describe the services, features or functions provided by the system for users. Whereas non-functional describes a set of constraints, characteristics, and properties on the systems, both in the development and operational environment [7]. According to Moertini [8], the key elements necessary to developed a website should be concern at the requirements stage. This research mainly concerns with requirements of e-commerce application that will be used as a component to develop a framework of e-commerce adoption. Moreover, this research will use the functional requirements from the previous result of research [9]. The requirements are shown in Table I. SMEs have to use these requirements provided in e-commerce application in order to experience the capabilities of e-commerce. These requirements help SMEs provide real-time

information to customers, update products, support communication with customer, manage account, conduct online transaction, and support dashboard information for SMEs.

TABLE I. FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS

Code	Requirements Functions	Code	Requirements Functions
F3	Product comparison	F36	Process refund
F5	Stock Availability	F37	Print invoices
F6	Product by category	F38	Print packing slips
F7	Sort Product by price/name/rating/reviews	F39	Cash on Delivery (COD)
F8	Product price discounts	F40	Cooperation with local bank
F9	Newsletter subscription management	F41	Bank Transferred
F10	Fixed amount discount promotions	F42	Credit Card
F11	Percent amount discount promotions	F43	Real time rate calculation
F12	Promotion new product	F44	Table rates for weight and destination
F13	Send page to friend (facebook, twitter, etc)	F45	Table rates for number of items and destination
F14	Promotional Banners	F46	For consumer top product, product review report, refund report, invoiced paid report, most viewed product report
F15	Like on Facebook	F47	For Low level management: order by customer report, product in shopping cart report, product review report, refund report, filter report by date range
F16	Live Chat	F48	For Middle level management: new customer report, new account report, order report, sales by product, sales by category, sales by item shipped report, refund report, most viewed product report
F17	Pools & Surveys	F49	Dashboard
F18	Advanced search	F50	Multi Language
F19	Search engine friendly	F51	Multi Currencies
F24	Online order history	NF1	Keeping content up-to-date
F25	Recently ordered items	NF2	Accepting online user feedback
F26	Address book with default billing and shipping addresses	NF3	Providing a business policy statement
F27	Newsletter subscription	NF4	Providing privacy policy statement
F28	Product review submitted	NF6	Information fit-to-task
F29	Real-time shipping rates from, such as JNE, TIKI, etc	NF7	Trust
F30	Register Users	NF8	Response times
F32	Shipping charge estimations	NF9	On-line completeness
F33	Save shopping charts	NF10	Relative advantage
F34	Order management: View, edit or fulfil orders from control panel		

B. *E-commerce Adoption in SMEs*

Many previous studies have explored the e-commerce adoption by SMEs. According to Hong [10], there are three drivers influenced SEMs to move toward e-commerce; i.e., technology integration, web functionalities, and web spending. The firms are earlier in the adoption of e-commerce since they have web-compatible technologies. The majority of Malaysian SMEs are classified under the basic web adoption level [11]. The website continuance intention by SMEs is greater if the perceived relative advantage of having online presence is greater too.

Researches related with e-commerce adoption in Indonesia are very limited. According to Yulimar, there are two factors effecting adoption e-commerce in Indonesia; these are, compatibility, and perceived benefit [12]. In addition to this, results obtained from Maryeni's study show that there are some variables of technology that influenced the adoption of e-commerce by manufacturing SMEs in Indonesia, particularly in West Java province [13]. These variables are relative advantage, compatibility, complexity, observability, planning, infrastructure, and security. According Govindaraju [5], the majority of Indonesia SMEs are still at the lower level of e-commerce adoption.

E-commerce adoption by SMEs is needed to be evaluated and measured. There is a stage model from the previous research done by Rao [4]. This research presented a stage model of e-commerce adoption based on functionality performed by e-commerce. The model has four levels: presence, portal, transaction and enterprise integration. The existing e-commerce adoption models have been designed based on technology perspective. A limitation of this study is that a stage model is descriptive. There is no detail facilitator explanation on what should be done to move to the next stage.

Triandini et.al. [9], [14][15] has developed a maturity model which had four stages, as shown in Table II. Each stage provides the characteristics of e-commerce used by SMEs. Each level of stage model also provides the benefits acquired by SMEs if they used e-commerce.

TABLE II. STAGE LEVEL OF E-COMMERCE ADOPTION

Level	Description
1 (Newcomer)	E-commerce has not been recognized as a means to achieve the benefits. There are basic characteristics of e-commerce, such as e-mail, social media, and static website
2 (Growing)	There is an awareness that e-commerce can be used to achieved the benefits. There are general e-commerce functionalities although it may not be used properly
3 (Established)	Best practice of e-commerce usage has emerged to achieve the benefits. There are e-commerce functionalities that enable integration with third-party business processes.
4 (Strategic)	E-commerce has played strategic roles in achieving benefits. All business processes with regard to achieving benefits mainly relies on e-commerce functionalities. New functionality to support the creation of new business processes may immerge.

C. Delphi Method

Delphi method is an iterative and consensus building approach to soliciting opinion and judgment by a group of experts on a particular topic. This method is useful when the opinions and judgments of experts and practitioners are needed but it is impossible for the panel to work together in the same physical location. Delphi method is characterized by anonymity, questionnaires with controlled feedback, and statistical analysis of the group's responses [16]. The Delphi method is suitable for this study because there is no adequate or appropriate method for data collection [16].

This study is the fourth phase of developing e-commerce adoption framework using Delphi method. The first phase recommended four levels of maturity model, 13 e-commerce benefits, 51 functionalities, and 9 non-functionalities [9]. The second phase presented a maturity model of e-commerce adoption based on benefits [9]. The third phase produced mapping between functional requirements into benefits of e-commerce adoption. The result of this phase has not been published, because there is a further research required to test the mapping. This fourth phase aims to map the functional requirements into level adoption.

Relationship from the first phase up to the fourth phase is described as follow: the first phase identified the number of levels adoption, benefits of e-commerce, functional and non-functional e-commerce application. The number of level was used to determine the level of framework. The benefits of e-commerce were used as indicator of achievement in each level of adoption. Meanwhile, the functional and non-functional requirements will be used as facilities provided in e-commerce application to reflect each adoption level. Our previous studies, i.e. the first and second phases of Delphi method, are shown in Table I and Table II.

III. METHODOLOGY

This study used the research model gained from the previous research [14]. The research model provides the adoption levels, functional and non-functional requirements, and indicators, as shown in Figure 1. This model contains a number level of e-commerce adoption. Each level has the benefits as indicators. Moreover, every level has the functional and non-functional requirements should be provided in e-commerce application to support the benefits that wanted to be achieved. To achieve the research objective, the following procedure was followed:

- Collecting data. This research used Delphi method with questionnaire as an instrument to get data related with mapping functions requirements into e-commerce adoption level. The questionnaire was divided into two parts. Part one is asking about respondent's information, such as business name, commodity, number of employee, total asset and sales. Part two is related to the requirements of e-commerce application which had to be mapped into levels. In this part, there are 51 questions, which are derived based on functionalities and non-functionalities of e-commerce application. The questionnaires were distributed to academicians, researchers and information technology practitioners. They were asked for their opinion to determine a right position of functions mapping into an adoption level. The questionnaires were sent to 15 respondents, however only 9 respondents replied the questionnaires.
- Calculating the consensus and mapping. After getting the opinion from the experts, the consensus score was calculated, as shown in Table III. Cronbach's alpha was used to measure and determine consensus among respondents of the member of an experts panel [17]. Next step was mapping the requirements into levels of e-commerce adoption.

IV. ANALYSIS AND RESULT

A. Analysis

This study evaluated reliability of the questionnaire and the consistency of the instrument using Cronbach's alpha. The acceptable level of reliability consistency should be higher then 0.60 [18]. This study had 51 numbers of questions that represented of requirements functions. The result of this study showed that the alpha value is 0.96. It was greater than recommended value of 0.70. Thus, it demonstrates that all requirements could be used and mapped into adoption level.

Table III showed the result of consensus from the experts. This consensus represents the percentage experts who decided to mapped a requirement to a specific level. Function F5 has a percentage value of 33.33 at level1, level 2 is 55.56, level 3 is 11.11 and level 4 is 0. Based on the percentage value, F5 is mapped to level 2. The same mechanism was applied to determine the level of other requirements.

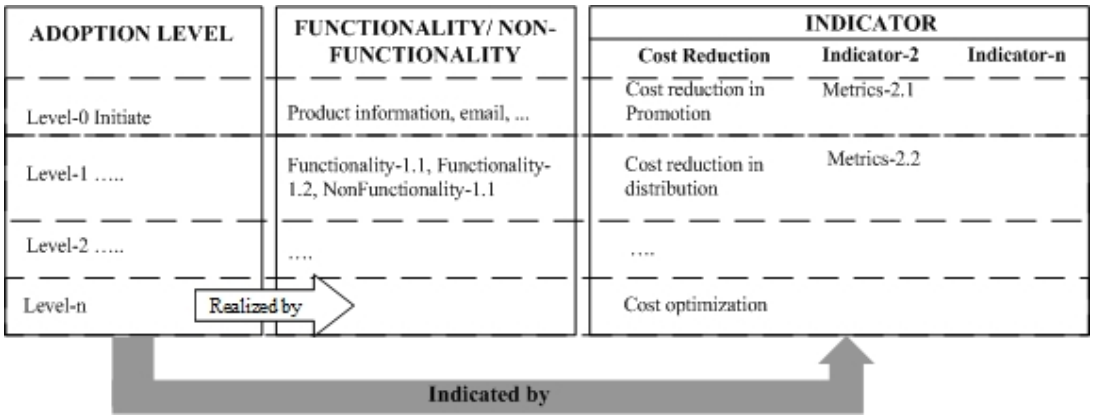

Figure 1. E-commerce Framework Model

TABLE III. CONSENSUS OF REQUIREMENTS

Req.Code	Consensus			
	Level 1	Level 2	Level 3	Level 4
F3	11.11	55.56	33.33	0.00
F5	33.33	55.56	11.11	0.00
F6	11.11	88.89	0.00	0.00
F7	11.11	77.78	11.11	0.00
F8	0.00	66.67	33.33	0.00
F9	22.22	44.44	0.00	33.33
F10	22.22	33.33	44.44	0.00
F11	33.33	22.22	44.44	0.00
F12	22.22	66.67	11.11	0.00
F13	33.33	44.44	11.11	11.11
F14	22.22	33.33	22.22	22.22
F15	44.44	44.44	11.11	0.00
F16	11.11	11.11	77.78	0.00
F17	0.00	22.22	33.33	44.44
F18	0.00	44.44	44.44	11.11
F19	11.11	66.67	11.11	11.11
F24	0.00	44.44	55.56	0.00
F25	11.11	55.56	33.33	0.00
F26	0.00	44.44	55.56	0.00
F27	33.33	22.22	22.22	22.22
F28	11.11	55.56	33.33	0.00
F29	0.00	11.11	88.89	0.00
F30	0.00	77.78	22.22	0.00
F32	11.11	44.44	44.44	0.00
F33	0.00	66.67	33.33	0.00
F34	0.00	66.67	33.33	0.00
F36	11.11	0.00	66.67	22.22
F37	11.11	22.22	66.67	0.00
F38	0.00	11.11	88.89	0.00
F39	22.22	22.22	44.44	11.11
F40	0.00	11.11	66.67	22.22
F41	22.22	22.22	55.56	0.00
F42	0.00	11.11	55.56	33.33
F43	0.00	11.11	77.78	11.11
F44	0.00	11.11	88.89	0.00
F45	0.00	11.11	88.89	0.00
F46	0.00	33.33	55.56	11.11
F47	0.00	22.22	55.56	22.22
F48	0.00	11.11	55.56	33.33
F49	0.00	11.11	66.67	22.22
F50	22.22	11.11	44.44	22.22
F51	0.00	11.11	55.56	33.33
NF1	33.33	44.44	22.22	0.00
NF2	22.22	22.22	55.56	0.00
NF3	44.44	33.33	11.11	11.11
NF4	44.44	33.33	0.00	22.22
NF6	11.11	44.44	44.44	0.00
NF7	33.33	33.33	11.11	22.22
NF8	44.44	44.44	0.00	11.11
NF9	11.11	22.22	66.67	0.00
NF10	0.00	22.22	44.44	33.33

B. Result

Based on the results of data processing, mapping was done by analyzing the mapping of each functionalities and non-functionalities into the level of e-commerce adoption. The result of mapping is: level 1 has six requirements, level 2 has 18 requirements and added with the requirements of level 1, level 3 has 28 requirements and added with the requirements of level 2, and level 4 has one requirements and added with the requirements of level 3, as shown in Table IV.

The functionalities and non-functionalities should be used regularly by SMEs or accessed regularly by consumers. If requirements provided in a level are used continuously, than the expectation level of adoption by SMEs will increase.

The result of this study supported the previous study conducted by Hong [10]. He found that one of the drivers affecting SMEs to use e-commerce is a web functionalities. The result of this study complements the existing limitation from the previous research. The former research did not provide the mapping of requirements to adoption levels [4]. Whereas, this framework provides the mapping which can be used as recommendation for improvement of the SMEs e-commerce adoption.

TABLE IV. MAPPING REQUIREMENTS INTO LEVEL

Level	Function Requirements						
1 (Newcomer)	F15	F27	NF3	NF4	NF7	NF8	
2 (Growing)	F3	F5	F6	F7	F8	F9	
	F12	F13	F14	F18	F19	F25	
	F28	F30	F32	F33	F34	NF1	
3 (Established)	F10	F11	F16	F24	F26	F29	F36
	F37	F38	F39	F40	F41	F42	F43
	F44	F45	F46	F47	F48	F49	F50
	F51	NF2	NF6	NF9	NF10		
4 (Strategic)	F17						

V. CONCLUSION AND FUTURE RESAERCH

This study has developed a framework of e-commerce adoption, which had requirements provided in e-commerce application. This framework also showed a number of functionalities and non-functionalities that should be provided at each adoption level. SMEs are expected to actively use functionalities and non-functionalities in the e-commerce application. In order to increase the level of e-commerce adoption, SMEs should use the available functionalities and non-functionalities in respective level regularly. Delphi method has been used to find the consensus between the experts about the mapping of requirements at each level e-commerce adoption.

The future work would be evaluating the e-commerce adoption framework on larger number of SME's in Indonesia. It requires a number of steps, which include infrastructure development, information system installation or configuration, trainings, data collection through activities logging and questionnaires distribution, e-commerce adoption measurements, and gap analysis. The future study would provide richer information and knowledge through case studies with regard to the proposed e-commerce adoption framework for SME's in Indonesia.

REFERENCES

[1] N. Al-Qirim, *Electronic Commerce in Small to Medium-Sized Enterprises: Frameworks, Issues and Implications,*. USA: IDEA Group Publishing, 2004.

[2] Hafied, N, "Adoption of E-commerce for small and medium enterprises: A case study of rural banks in the Depok city," Universitas Indonesia, Indonesoa, 2007.

[3] F. Wahid and L. Iswari, "Information Technology Adoption by Small and Medium Enterprises in Indonesia," in *The National Seminar on Information Technology Application*, 2007, pp. 75–79.

[4] S. Rao and G. Metts, "Electronic Commerce Development in Small and Medium Sized Enterprises A Stage Model and Its Implications," *Bus. Process Manag. J.*, vol. 9, pp. 11–32, 2003.

[5] R. Govindaraju and D. R. Chandra, "E-commerce adoption by Indonesian small, medium, and micro enterprises (SMMEs): Analysis of goals and barriers," in *2011 IEEE 3rd International Conference on Communication Software and Networks (ICCSN)*, 2011, pp. 113–117.

[6] J. Wiegers, Karl; Beatty, *Software Requirements*, Third. Microsoft Press, 2013.

[7] D. Siahaan, *Requirements Analysis in Software Engineering (Analisa Kebutuhan dalam Rekayasa Perangkat Lunak)*. Yogyakarta: Andi Offset, 2012.

[8] V. S. Moertini, S. Heriyanto, and C. D. Nugroho, "Requirement Analysis Method of E-commerce Websites Development for Small - Medium Enterprises , Case Study : Indonesia," vol. 5, no. 2, pp. 11–28, 2014.

[9] E. Triandini, A. Djunaidy, and D. Siahaan, "A Maturity Model for E-Commerce Adoption By Small And Medium Enterprises In Indonesia," *J. Electron. Commer. Organ.*, vol. 15, no. 1, pp. 44–58, 2017.

[10] W. Hong and Ke. Zhu, "Migrating to internet-based e-commerce: Factors affecting e-commerce adoption and migration at the firm level," *Inf. Manag.*, vol. 43, pp. 204–221, 2006.

[11] T. Ramayah, N. S. Ling, S. K. Taghizadeh, and S. A. Rahman, "Telematics and Informatics Factors influencing SMEs website continuance intention in Malaysia," *Telemat. Informatics*, vol. 33, no. 1, pp. 150–164, 2016.

[12] V. yulimar, "Analysis of factors affecting the adoption of electronic comerce and company (Study on small and medium company in Indonesia)," Universitas Diponegoro, Semarang, 2006.

[13] Y. Y. Maryeni, R. Govindaraju, B. Prihartono, and I. Sudirman, "Technological and organizational factors influencing the e-commerce adoption by Indonesian SMEs," in *2012 IEEE International Conference on Management of Innovation and Technology (ICMIT)*, 2012, pp. 436–441.

[14] E. Triandini, A. Djunaidy, and D. Siahaan, "Development of a conceptual model of E-commerce adoption for SMEs in Indonesia," *2013 Int. Conf. Inf. Technol. Electr. Eng.*, pp. 93–96, 2013.

[15] E. Triandini, A. Djunaidy, and D. Siahaan, "Determining E-commerce Adoption Level by SMEs in Indonesia Based on Customer-Oriented Benefits," 2014, pp. 281–285.

[16] M. Yousuf, "Using Experts' Opinions Through Delphi Technique," *Pract. Assessment, Res. Eval.*, vol. 12, no. 4, 2007.

[17] B. Graham, G. Regehr, and J. G. Wright, "Delphi as a method to establish consensus for diagnostic criteria.," *J. Clin. Epidemiol.*, vol. 56, no. 12, pp. 1150–6, Dec. 2003.

[18] C. . Kothari, *Research Methodology: Methods and Techniques (Second Revision)*. New Delhi: New Age International, 2004.