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Testing the Validity of Maturity Model for E-Government Implementation in Indonesia

Darmawan Napitupulu, Dana Indra Sensuse, Aniati Murni

***Abstract*—**The research was conducted to empirically validate the proposed maturity model of e-Government implementation, composed of four dimensions, further specified by 54 success factors as attributes. To do so, there are two steps were performed. First, expert's judgment was conducted to test its content validity. The second, reliability study was performed to evaluate inter-rater agreement by using Fleiss Kappa approach. The kappa statistic (kappa coefficient) is the most commonly used method for testing the consistency among raters. Fleiss Kappa was a generalization of Kappa in extensions to the case of more than two raters (multiple raters) with multi-categorical ratings. Our findings show that most attributes of the proposed model were related to their corresponding dimensions. According to our results, The percentage of agree answers given by the experts was 73.69% in dimension A, 89.76% in B, 81.5% in C and 60.37% in D. This means that more than half of the attributes of each dimensions were appropriate or relevant to the dimensions they were supposed to measure, while 85% of attributes were relevant enough to their corresponding dimensions. Inter-rater reliability coefficient also showed satisfactory result and interpreted as substantial agreement among raters. Therefore, the proposed model in this paper was valid and reliable to measure the maturity of e-Government implementation.

***Keywords*—**E-Government, Model, Maturity, Validity, Reliability Kappa.

I. Introduction

THE great potential that ICT possesses to support government processes has been recognized worldwide, those are in order to create interconnectivity networks to improve the efficiency of service delivery, to encourage citizen participation and to increase the transparency of administrative processes [1]. Even though there is no universally accepted definition of the concept of e-Government, some literature of definition was mostly cited. United Nations defined e-Government: "… utilizing the internet and the world-wide-web for delivering government information and services to citizens" [2]. Tung and Rieck defined it as the use of ICT to enhance public administration processes [3]. Ke and Wei described e-Government as the use of Internet technology to enable greater interaction between government organizations and its citizens [4]. Thus it can be said that e-Government initiatives arise due to a combination of the need to improve the quality and efficiency of public services and the acceptance of ICT as an important element to achieve that goal [5].

But electronic government is far more than using technology to provide online services [6], [7]. It often involves the integration of different services provided by public agencies that had never worked together previously, the provision of 24/7 service delivery, the assimilation of new laws and government regulations, and so on [8]. The old paradigm of assuming e-Government only about technology had made e-Government implementation failed [9]. ICT is an integral part of successful e-Government implementation [10]. Therefore, technological change should be accompanied by organizational change process redesign, IT governance implementation (alignment between IT resources and business objectives) and human capital. It is also essential to consider how all these aspects interact with each other [5].

E-Government implementation can result in significant benefits such as improved efficiencies, greater access to services, greater accountability, transparency and citizen empowerment [3], [11], lowered costs and time for services [12], [13], strategic advantages such as improved decision making through streamlining of information, enhanced knowledge sharing and organizational learning, improved interactions with citizens, other government organizations and businesses and industry, leveraging market forces for better relationships between government and private sectors, and greater ability to effect organizational change management [14], [15]. Tolbert and Mossberger reported that increasing use of e-Government by citizens also lead to increased trust in local government and also in positive attitudes towards e-Government processes [16]. Prattipati reported that there is wide variance in the adoption of e-governance and use of online government services among countries [17]. In 2013, World e-Government Survey of Waseda University also reported that e-Government adoption speed was quite different among countries especially between developed and developing countries. It showed that Singapore, Finland and USA had reached top three of survey, in the other hand Indonesia as developing country was in 40th of total 55 countries, left behind Vietnam and Thailand [18]. Singapore, which was currently rated as first among all nations in e-Government ranking, is actualizing USD (US Dollars) 14.5 million savings in benefits [4], [18]-[20].

Chen noted that despite key differences in technological and social aspects of developed and developing countries, most developing countries have followed best practices and strategies used in e-Government implementation in developed countries but unfortunately they highlighted that lessons learned from e-Government implementations in developed countries could not be transposed to developing countries with complete success [21]. Therefore in the previous research, the

Darmawan Napitupulu, Dana Indra Sensuse, and Aniati Murni are with the University of Indonesia, Depok, West Java Indonesia (e-mail: darwan.na70@gmail.com, dana@cs.ui.ac.id, aniati@cs.ui.ac.id).

maturity model of e-Government implementation in Indonesia had been developed [22]. The model which was proposed based on success factors, composed of four dimensions, further specified by 54 success factors as attributes. This study focuses on testing validity and reliability of the model according to expert opinion (expert judgment). In this paper, expert's agreement on each attributes to its corresponding dimension were asked and analyzed to support the model.

II. Literature Review

TABLE I
THE FOUR DIMENSIONAL MATURITY MODEL OF E-GOVERNMENT IMPLEMENTATION

Dimension	Code	Attribute/Item
A - Input	A1	ICT Infrastructure
	A2	Strong Leadership
	A3	Good Planning
	A4	Good Team Skills & Expertise
	A5	Best Practice Consideration
	A6	Enough Funding
	A7	Supportive Government Policy
	A8	Political Support & Stability
	A9	Good Outsourcing Strategy
	A10	User/Citizen Internet Literacy
	A11	Good & Clear Organizational Structure
	A12	International Support
	A13	System Security
	A14	Legal Framework
	A15	Supportive Cultural Environment
	A16	Citizen Relationship Management
	A17	Top Management Support
	A18	System Development Methodology
	A19	Re-Usable
	A20	Willing to Change
	A21	Innovations
	A22	External Pressure
	A23	Prioritization of e-Government
B - Process	B1	User Involvement
	B2	Training
	B3	System Campaign
	B4	Good Coordination
	B5	Monitoring & Evaluation
	B6	Good Partnership
	B7	Good Change Management
	B8	Good System Modeling
	B9	Support Interoperability
	B10	Good Project Management
	B11	Good IT Governance
	B12	Gradual Implementation
	B13	Continuous Improvement
C – Output	C1	Portal
	C2	Good System Usability
	C3	Prototype
	C4	Good Information Quality
	C5	Good System Quality
	C6	Good Service Quality
	C7	Online Payment
	C8	E-Participation
	C9	Guidelines for e-Government Implementation
	C10	Reward & Recognition
D - Outcome	D1	Better Business Process
	D2	Awareness
	D3	Deal with Birocratic
	D4	Trust
	D5	Citizen Satisfaction
	D6	Highly Demand of Citizen
	D7	Self Sustainable Revenue
	D8	Market Synergy

The high failure of e-Government implementation based on various survey [18], [23], [24] especially in developing countries including Indonesia had motivated researcher to perform the study of critical success factors (CSFs) that influence successful e-Government implementation. CSFs in general have been one of the earliest and most actively research topics. They can be defined as a limited number of areas, in which results, if they are satisfactory, will assure successful performance [25]. According to this definition, our purpose was to define the groups of CSF that determine the success of e-Government implementation. The study which was conducted by researcher in the previous research, had defined 54 success factors or attributes that should be accommodated to ensure successful e-Government implementation [22]. Then all success factors had been categorized into four dimensions (Input, Process, Output and Outcome) of e-Government Maturity Model by using factor analysis [33], described in detail in Table I.

The four dimensions and 54 attributes of maturity model of e-Government implementation served what organizational aspects should be assessed, monitored and acted upon in order to ensure successful e-Government implementation. However, and to our knowledge, the validity of the model should be empirically tested especially the correspondence between the attributes and dimensions. In this context, if there was a lack of empirical correspondence between the attributes and the dimensions proposed by the model, the scores on the dimensions obtained from e-Government maturity assessments could lead to misleading inferences. Therefore, we believe that testing the correspondence between the attributes and dimensions is of great importance and contributes to obtaining evidence about the validity of the proposed model.

III. Methodology

A. Content Validity

The purpose of this study is to test the correspondence between the attributes and dimensions by evaluating content validity through expert judgment analysis. Content validity is assessed through rating or agreement by experts not the researcher, as necessary empirical validation of the model in order to maximize its practical usefulness for government institution [26]. In this paper, research methodology used to evaluate content validity was survey, based on questionnaire which distributed to 6 experts, who were highly knowledgeable in e-Government area. The participants came from four academician (hold PhD degree) working in the department of computer science especially for e-Government laboratory or research and two professional expertise consultant in e-Government industry. By rating the questionnaire in nominal scale (1=disagree, 2=agree), experts made agreement about the relevance of the 54 attributes to the four dimensions of the proposed model. If experts disagree of any attribute belong to dimension identified by the model, then they have to response and write to which dimension of an attribute supposed to belong. The participants were also encouraged not to leave any attribute without a response. For simplicity, an agree answer is scored when an expert successfully classifies an attribute in the dimension it belongs to according to the model. Disagree answers reflect an inappropriate classification of attributes into dimensions [27]. To get a global view of the content validity of the model, the expert's answers were analyzed at a global level and the average of expert agrees answers for each of the dimensions of the model was calculated. By following Castro et al., researcher proposed only a criterion to determine whether an attribute was relevant enough to the dimension to which it was supposed to belong. The more restrictive (MR) criterion considered an attribute to be relevant when every attribute that was allocated to its corresponding dimension by at least half of the experts [27].

B. Kappa Inter-Reliability

TABLE II
INTERPRETATION OF KAPPA

Kappa (κ)	Agreement
<0	Poor
0.01 – 0.20	Slight
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61- 0.80	Substantial
0.81- 1.00	Almost perfect

In this paper, in order to understand whether or not the experts share the same opinions (the reliability of expert opinions), Fleiss' kappa coefficient proposed by Fleiss, was used to estimate inter-observer agreement (inter-rater reliability) among experts for testing the significance and internal consistency [28]. Fleiss' kappa is a statistical measure for the assessment of the reliability of agreement between ≥ 2 raters (multi-rater kappa) when classifying categorical items and measures the degree of agreement in classification over that which would be expected by chance. It is generally thought that kappa is well-known and robust measure because kappa takes into account the agreement occurring by chance [29], [30]. Whereas kappa (Cohen's kappa) work for only two raters, Fleiss' kappa works for any number of raters giving categorical ratings (nominal data), to a fixed number of items. It can be interpreted as expressing the extent to which the observed amount of agreement among raters exceeds what would be expected if all raters made their ratings completely randomly. It is important to note that whereas Cohen's kappa assumes the same two raters have rated a set of items, Fleiss' kappa specifically assume a fixed number of raters (e.g., three) [28]. Agreement can be thought of as follows, if a fixed number of people assign numerical ratings to a number of items then the kappa will give a measure for how consistent the ratings are. The kappa (κ) can be defined as,

$$\kappa = \frac{Þ - Þe}{1 - Þe} \quad (1)$$

The factor 1-Þe gives the degree of agreement that is attainable above chance, and Þ-Þe gives the degree of agreement actually achieved above chance. If the raters are in complete agreement then κ=1. If there is no agreement among the raters (other than what would be expected by chance), κ≤0. Landis and Koch gave Table II for interpreting values, as the number of categories and subjects will affect the magnitude of the value. The kappa will be higher when there are fewer categories [31], [32].

IV. RESULT & DISCUSSION

TABLE III
THE CORRESPONDENCE BETWEEN ATTRIBUTES AND DIMENSIONS OF MODEL

Att	Dimension				MR
	A-Input	B-Process	C-Output	D-Outcome	
A1	**100%**	0	0	0	X
A2	**83%**	17%	0	0	X
A3	**33%**	67%	0	0	
A4	**66%**	0	17%	17%	X
A5	**67%**	33%	0	0	X
A6	**100%**	0	0	0	X
A7	**100%**	0	0	0	X
A8	**66%**	17%	17%	0	X
A9	**33%**	67%	0	0	
A10	**83%**	0	0	17%	X
A11	**100%**	0	0	0	X
A12	**83%**	17%	0	0	X
A13	**50%**	33%	17%	0	X
A14	**66%**	0	17%	17%	X
A15	**83%**	0	0	17%	X
A16	**33%**	50%	0	17%	
A17	**83%**	17%	0	0	X
A18	**67%**	0	33%	0	X
A19	**100%**	0	0	0	X
A20	**50%**	0	17%	33%	X
A21	**66%**	17%	0	17%	X
A22	**100%**	0	0	0	X
A23	**83%**	17%	0	0	X
B1	0	**100%**	0	0	X
B2	0	**100%**	0	0	X
B3	33%	**67%**	0	0	X
B4	0	**100%**	0	0	X
B5	0	**100%**	0	0	X
B6	0	**100%**	0	0	X
B7	0	**67%**	0	33%	X
B8	0	**100%**	0	0	X
B9	67%	**33%**	0	0	
B10	0	**100%**	0	0	X
B11	0	**100%**	0	0	X
B12	0	**100%**	0	0	X
B13	0	**100%**	0	0	X
C1	0	0	**100%**	0	X
C2	0	0	**100%**	0	X
C3	0	0	**100%**	0	X
C4	0	0	**83%**	17%	X
C5	0	0	**83%**	17%	X
C6	0	0	**83%**	17%	X
C7	0	0	**100%**	0	X
C8	0	0	**33%**	67%	
C9	33%	17%	**50%**	0	X
C10	0	17%	**83%**	0	X
D1	0	17%	0	**83%**	X
D2	100%	0	0	**0**	
D3	0	67%	17%	**17%**	
D4	17%	0	0	**83%**	X
D5	0	0	0	**100%**	X
D6	83%	0	0	**17%**	
D7	0	0	0	**100%**	X
D8	17%	0	0	**83%**	X

Note: Marks in columns LR and MR indicate attributes showing content validity under less restrictive and more restrictive conditions respectively. Percentages of experts allocating attributes to its corresponding dimension are shown in bold.

Testing the validity of the proposed model especially the correspondence between attributes and dimensions were conducted through expert judgment analysis. As said above, an agree answer is scored when an expert successfully classifies an attribute in the dimension it belongs to according to the model. Disagree answers reflect an inappropriate classification of attributes into dimensions. To get a global view of the content validity of the model, the expert's answers were analyzed at a global level by calculating the average of expert agree answers for each of the dimensions of model as shown in Table III.

TABLE IV
DIAGNOSIS RESULT ON 54 SUBJECTS RATING BY SIX RATERS

Subject	Category				P_i
	A (j=1)	B (j=2)	C (j=3)	D (j=4)	
1	6	0	0	0	1.000
2	5	1	0	0	0.667
3	2	4	0	0	0.467
4	4	0	1	1	0.400
5	4	2	0	0	0.467
6	6	0	0	0	1.000
7	6	0	0	0	1.000
8	4	1	1	0	0.400
9	2	4	0	0	0.467
10	5	0	0	1	0.667
11	6	0	0	0	1.000
12	5	1	0	0	0.667
13	3	2	1	0	0.267
14	4	0	1	1	0.400
15	5	0	0	1	0.667
16	2	3	0	1	0.267
17	5	1	0	0	0.667
18	4	0	2	0	0.467
19	6	0	0	0	1.000
20	3	0	1	2	0.267
21	4	1	0	1	0.400
22	6	0	0	0	1.000
23	5	1	0	0	0.667
24	0	6	0	0	1.000
25	0	6	0	0	1.000
26	2	4	0	0	0.467
27	0	6	0	0	1.000
28	0	6	0	0	1.000
29	0	6	0	0	1.000
30	0	4	0	2	0.467
31	0	6	0	0	1.000
32	4	2	0	0	0.467
33	0	6	0	0	1.000
34	0	6	0	0	1.000
35	0	6	0	0	1.000
36	0	6	0	0	1.000
37	0	0	6	0	1.000
38	0	0	6	0	1.000
39	0	0	6	0	1.000
40	0	0	5	1	0.667
41	0	0	5	1	0.667
42	0	0	5	1	0.667
43	0	0	6	0	1.000
44	0	0	2	4	0.467
45	2	1	3	0	0.267
46	0	1	5	0	0.667
47	0	1	0	5	0.667
48	6	0	0	0	1.000
49	0	4	1	1	0.400
50	1	0	0	5	0.667
51	0	0	0	6	1.000
52	5	0	0	1	0.667
53	0	0	0	6	1.000
54	1	0	0	5	0.667
Total	126	94	55	49	
P_j	0.379	0.302	0.176	0.142	

The percentage of agree answers given by the experts was 73.69% in dimension A, 89.76% in B, 81.5% in C and 60.37% in D. This means that according to the judgment of experts, more than half of the attributes of dimensions A, B, C and D were appropriate or relevant to the dimensions they were supposed to measure, while dimension B offered the highest content validity. Finally, content validity was checked for each of the 54 attributes of the model. To do this, the percentage of experts assigning each of the attributes to each of the four dimensions of the model was calculated. A great variance was found in Table III, ranging from 0% of experts placing attribute D2 in its corresponding dimension to 100% of experts placing attribute A1, A6, A7, A11, A19, A22, B1, B2, B4, B5, B6, B8, B10, B11, B12, B13, C1, C2, C3, C7, D2, D5 and D7 in their corresponding dimensions. Researcher proposed the criteria to determine whether an attribute was relevant enough to the dimension to which it was supposed to belong. The more restrictive (MR) criterion considered an attribute to be relevant when every attribute that was allocated to its corresponding dimension by at least half of the experts. Result under more restrictive conditions indicated that 46 (85%) attributes were relevant enough to their corresponding dimensions: 20 attributes that were supposed to measure dimension A (A1-A2, A4-A8, A10-A15 and A17-A23); 12 attributes in dimension B (B1-B8 and B10-B13); 9 attributes in dimension C (C1-C7 and C9-C10) and 5 attributes in dimension D (D1, D4, D5, D7 and D8). This means that under more restrictive criterion, 15% of the attributes of the model were not relevant indicators of the dimensions they were supposed to measure. They are: A3, A9 and A16 were supposed to dimension B; B9 to dimension A; C8 to dimension D; D2 and D6 were supposed to dimension A and D3 to dimension B. As a conclusion according to expert judgment, the proposed maturity model for e-Government implementation had high content validity. In Table IV, a diagnosis and calculation of kappa coefficient was conducted. Six raters (η=6) assigned 54 attributes or subjects (N=54) to a total of four categories (κ=4). The categories are presented in the columns, while the subjects are presented in the rows. Each cell is filled with the number of raters who agreed that a certain subject belongs to a certain category.

From Table IV, sum of all cells calculated was 324 for 54 subjects. In order to calculate Þ, we need to count the sum of P_i as follows:

$$\sum_{i=1}^{N} \mathrm{Pi} = 1.000 + 0.667 + \cdots + 0.467 = 39.133 \qquad (2)$$

Over the whole sheet,

$$Þ = \frac{1}{N}\sum_{i=1}^{N} \mathrm{Pi} = \frac{1}{54}(34.733) = 0.725$$

$$Þe = \sum_{j=1}^{k} \mathrm{Pj}^2 = 0.379^2 + 0.302^2 + 0.176^2 + 0.142^2 = 0.286$$

$$\kappa = {0.725 - 0.286}/{1 - 0.286} = 0.614$$

From the result, it could be shown that Fleiss' kappa coefficient (κ) was 0.614 which could be interpreted as substantial agreement among raters or experts (≥0.61) according to Table II Interpretation of kappa. That means the inter-rater reliability was satisfactory because the Fleiss kappa coefficient obtained high measure.

V. Conclusion

Content validity and inter-rater reliability of the proposed maturity model of e-Government implementation had been tested. According to our results, more than half of the attributes of dimensions A, B, C and D were relevant to the dimensions they were supposed to measure. In another word, each dimensions empirically had high content validity. The content validity was also checked for each of the 54 attributes of the model. The result also showed that most of attributes (85%) were appropriate enough to their corresponding dimensions. Inter-rater reliability was calculated by using Fleiss Kappa approach to evaluate the internal consistency among raters. The result showed satisfactory result and interpreted as substantial agreement (≥0.61). As a conclusion, the proposed model was valid and reliable to measure the maturity of e-Government implementation especially in Indonesia.

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