E-Government Maturity Model to Support System Dynamics in Public Policymaking

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Abstract— **In this paper, the main output of e-government is designed to assist a policymaker to create a comprehensive public policy. The policy is developed by studying the political and social issues in holistic way. System Dynamics based on Big Data from e-government infrastructure is suggested as the method for obtaining a comprehensive solution. The solution is selected from some possible scenarios by running simulation on the model of System Dynamics. The policymaker uses this solution as an input for public policymaking. Unfortunately, no E-Government Maturity Model (EMM) has given attention to incorporate Big Data and System Dynamics for Public Policymaking. In this case, a new EMM is proposed. It consists of several stages. Each stage is identified by the range of intensity or level of several criteria or indicators. Some criteria or indicators are proposed by considering technical and non-technical aspect, such as Leadership / Policy, IT Infrastructure, Information Processing (Application), Human Resources and Organization Culture. At the end of this paper, the survey is conducted to identify the current level or stage of EMM of one of government institution in Indonesia. (***Abstract***)**

Keywords—E-Government, System Dynamics, Public Policy, Big Data (key words)

I. INTRODUCTION

The E-Government Maturity Model (EMM) is used as a guideline to develop e-government from the lowest stage until the highest stage or mature position. The process of movement from the worst position (first stage) to the best position (last stage) is done gradually. To make the movement runs smoothly, it will be broken down into several stages. These multiple stages of EMM are to assist in manageability of the development of e-government. Fath-Allah et al. show that some experts introduce several models [1]. Each model consists of several stages. The total stages of each modal are variety. The most minimum stages are introduced by Reddick Maturity Model [2]. It is 2-stage model which is similar to our basic diagram (see Figure 1).

In designing EMM, the requirement from stage one until the final stage is determined by some criteria or indicators. The objective of each stage is stated. Each objective should align with the main expected output of e-government which is to achieve the expected result or maturity position. A review can be done to identify if there is any deviation in each stage. It should have its own strategy to accelerate to achieve maturity stage. The establishment of stages in E-Government development is (1) to provide clear direction for e-government development, (2) to facilitate the determination of strategies based on objective of each stage in E-Government development, (3) to solve problem and focus on each stage of E-Government development, and (4) to assist in preparing public policymaking based on data and information.

In this paper, the lowest or first stage is the basic condition of the IT usage in the government. It is the minimum utilization of IT. The final stage is the expected stage and it is usually called as maturity position or stage. The maturity stage is the e-government condition which the public policymaking is created based on system dynamics and Big Data. Nasution et al. [5] gives a good explanation how system dynamics and Big Data contribute for public policymaking. Basically, the Big Data provides the data, information and knowledge to assist in modelling of system dynamics. The model is created to mimic the real system which the issues or problems are situated. After finalizing the model, some scenarios are simulated on the model to find the best outcome to solve the problem. The best outcome of this simulation becomes the input to the public policymaking.

Big Data has more complexity then ordinary data, especially (1) it is involved more technologies and more arrangement of data analytics techniques (2) the data is huge and distributed in several systems. It becomes double complexity if Big Data is used to find a solution of another complex problem, such as public policymaking. At this moment, Big Data has a limitation to assist in solving problem of complex system, such as in public policymaking. In this case, the new method is needed to overcome this limitation. The method should be able to run the analytics on all aspects, not only technical aspects but also non technical aspects which are commonly happened in public policymaking. Multiple factors are studied such as how the new public policy increases satisfaction to group of people and reduce negative sentiment of other group. What the balancing way is to

optimize the outcome of the public policy. It is inclusive the unanticipated side effects of the public policy implementation.

Solving unstructured of complex system and its behaviours need special analytics techniques and methods. One of them which is usually used in the unstructured of complex system is based on the system theory, in more specific, System Dynamics (SD). It becomes our main objective that the output of proposed EMM should be able to support public policymaking by utilizing SD approach and Big Data. Big Data in the e-government is provided to assist in SD model creation. The model is the key in the SD.

Below is the basic diagram of EMM. After defining the first and final stage, the breakdown process is run on it to identify the stages between first and final stage. Each stage is identified with some important criteria and how it's interconnected from previous stage and next stage. It is structurally broken down. The rating of E-Government Maturity is based on the combination capability of criteria or indicators. It could be only in technical aspect or combination between technical and non technical aspect. PeGI stands for Pemeringkatan e-Government Indonesia (E-Government Indonesia Rating) which is published by Indonesia Government has its own rating [6]. Its rating is based on the criteria of the capability of (1) Planning, (2) Application, (3) Infrastructure, (4) Organization, and (5) Policy [6]. Basically, the functionality of criteria or indicators is related to IT in the government organization. Based on the PeGI, it is not only technical aspect to make the e-government successful. Planning, Organization and Policy are non technical aspect which is considered equally with the technical aspect, such as Application and Infrastructure.
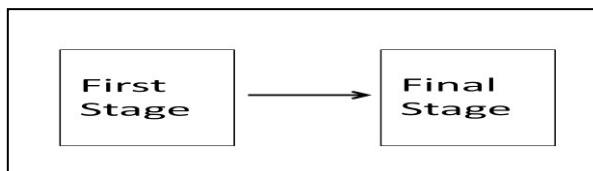

Fig. 1. Basic Diagram of E-Government Maturity Model (EEM)

In our perspective, the main target of a true e-government is its contribution in public policymaking. This aim is the objective of our proposed EMM. It will impact to the way how the stages are designed. In this paper, public policymaking is offered by collaborating Big Data and SD. Big Data has huge capacity to store data and information, and it is used for modelling the issues or problem. Systems dynamics approach uses the model to find its solution by simulating some possible scenarios in multiple perspective [7]. It can look at a problem holistically.

The Big Data are related closely to E-Government. It is only one of the components in E-Government [6]. The success of Big Data implementation should be aligned with E-Government development. Without a proper E-Government development, Big Data will not be utilized optimally. The E-Government development is directed by the selected EMM. Selection of EMM is a critical initiation for long term E-Government development. In the next section, some existing E-Government Maturity Model (EMM) will be discussed and categorized before proposing a new EMM which is suitable for our requirement.

II. METHODOLOGY

This research will use comparative and qualitative approach. The results of previous research of EMM are collected and reviewed. The models are compared to understand the outline. The purpose of this comparative study is (1) to discover the similarities and differences of the stages between each EMM, (2) to compare the objective and properties between each EMM (3) to generalize the level of comparison based on the new perspective of the stages of EMM, (4) to determine which one is better or which one should be selected, (5) to investigate the possibility of causal relationships between the stages, and (6) to rediscover new factors that may be the cause the revision.

The main steps in comparative research are used as follows (1) Formulate and define the problem. (2) Examine the existing literature. (3) Formulate the theoretical framework. (4) Develop research design. (5) Conduct survey and analysis. (6) Make conclusions. (7) Arrange the report by scientific writing.

A. Problem Formulation

E-Government Maturity Model (EMM) has to support public policymaking. Unfortunately, final stage of some models is not stop at public policymaking. They are more focus to technical aspect only. In our perspective, supporting public policymaking is the goal of E-Government. It becomes the main goal. Nasution et al. [7] proposes to use system dynamics to optimize the contribution of Big Data in E-Government for public policymaking. System dynamics could give a holistic and comprehensive perspective in understanding the problem situation. The system dynamics is the mediating variable in this case [8]. Therefore, the readiness of Big Data in E-Government is the most important key factor for public policymaking based on system dynamics. It is in line with a model which is created by Brí [9], where system thinking and system dynamics is put on the highest stage. Although without a clear rating system, at least Brí [9] introduces another perspective of EMM.

B. Literature Review

Experts have different definitions of E-Government [10][11]. Sometimes, it is defined according to each individual or institution based on its work plan. Here's definition of E-Government by experts:

1) World Bank

E-Government is the use of information technology (such as Wide Area Networks, Internet and other advanced technology) by governments that are able to transform government communications with the public, business or fellow governments.

2) UNDP (United Nations Development Program)

E-Government is the use of Information and Communication Technology (ICT) by government agencies.

3) Ministry of Communications and Informatics of USA

E-Government is an Internet-based information technology application and other digital devices managed by the government to communities, business partners, employees, business entities, and other online institutions.

4) The Government of New Zealand

E-Government is a new way of using technology by governments to provide easier access to information and government services for the community, to improve the quality of services and open wider opportunities for people to participate in democratic governance.

5) Jim Flyzk (US Department of Treasury)

E-Government is about bringing government into the internet world and working in internet time.

In our perspective, E-Government is a system based on IT and its related factors for providing service via internet, intranet and extranet to government officer, citizen and foreigner for the advantage to the country in the secure manner and assist in public policymaking. Everybody such as government officer, citizen and foreigner could participate in the public policymaking via the provided service. It is developed in each stage of EMM until E-Government is mature enough to provide the necessary system. It is in the last stage for some models.

Regardless of the definition, Governments in developed countries that have implemented E-Government, view that E-Government implementation should be done quickly and seriously. E-Government is considered to give a benefit to the country. Benefits of E-Government, among others are:

- E-Government can improve the quality of government services to the community, business partners, industry, business entities and other institutions in terms of effectiveness and efficiency in various aspects of the life of the state.

- E-Government is considered capable of increasing transparency, control, accountability of governmental administration in order to realize good governance.

- E-Government can reduce the administrative costs, relationships and interactions, which are issued by the government and stakeholders in daily activities significantly.

- E-Government is able to provide new sources of revenue for the government through interaction with interested parties.

- E-Government can create a new environmental society that can answer all issues reported quickly and accurately in accordance with the global changes that occur.

- E-Government can empower communities and other stakeholders to become government partners in terms of democratic processes and public policymaking.

C. Theoretical Framework

Some literatures are discussed about the EMM [1]. They are discussed about the following models: Layne and Lee [12], Andersen and Henriksen [13], United Nations [14], Alhomod et al. [15], Hiller and Belanger [16], Almazan and Gil-Garcia [17], Cisco [18], Baum and Di-Maio [19], West [20], Moon [21], Toasaki [22], Deloitte and Touche [23], Howard [24], Shahkooh et al. [25], Lee and Kwak [26], Siau and Long [27], Wescott [28], Chandler and Emanuel [29], Kim and Grant [30], Chen et al. [31], Windley [32], Reddick [2], Rohleder and Jupp [33], NOA[34], Netchaeva [35], Finn de Bri [9] and PeGI [6].

From many models which are has been discussed before, the minimum of the stages of E-Government Maturity Model are two [2] and the maximum is eight [9]. There are advantages and disadvantages if the total stages are too small or too big. If it is too small, it is more difficult to control the development from one stage to the other stage. If it is too big, it is more complicated to manage because too many stages. If the middle number between two (the minimum) and eight (the maximum) is used, five is the moderate number. This number will be used to categorize all stages of reviewed EMM. It is almost similar as explained by some experts [21][25][27]. The proposed model is called as 5-stage model.

In this paper, all those models are summarized into a table as below. On each model, number 1 – 5 is to represent the stage of the model. Symbol X means Not Applicable (NA) because it is not covered in the discussion of the model.

TABLE I.   SUMMARY OF E-GOVERNMENT MODEL IN 5-STAGE MODEL

No	Model	Stage				
		1	*2*	*3*	*4*	*5*
1	**Layne and Lee**	1	X	2	3,4	X
2	**Andersen and Henriksen**	X	X	X	1-4	X
3	**United Nations**	1,4	2,4	3,4	X	X
4	**Alhomod**	1	2	3	4	X
5	**Hiller and Belanger**	1	2	3	4	5
6	**Almazan and Gil-Garcia**	1,2	3	4	5	6
7	**Cisco**	1	X	2	3	X
8	**Gartner Group**	1	2	3	4	X
9	**West**	1	X	X	3-5	X
10	**Moon**	1	2	3	4	5
11	**World Bank**	1	2	3	X	X
12	**Deloitte and Touche**	1	2	2	3-6	X

No	Model	Stage				
		1	*2*	*3*	*4*	*5*
13	**Howard**	1	2	2	3	X
14	**Shahkooh**	1	2	3	4	5
15	**Lee and Kwak**	1	2,3	X	4,5	X
16	**Siau and Long**	1	2	3	4	5
17	**Wescott**	X	1-3	4	5	6
18	**Chandler and Emanuel**	1	2	3	4	X
19	**Kim and Grant**	1,2	X	3	4	5
20	**Chen**	1	2	X	3	X
21	**Windley**	1	2	X	X	3,4
22	**Reddick**	1	X	2	X	X
23	**Accenture**	1,2	X	X	3,4	5
24	**UK**	1,2	3	4	5	X
25	**Netchaeva**	1	2,3	4	X	5
26	**Finn de Bri**	1-3	X	X	4-7	8
27	**PeGI**	1-5	1-5	1-5	1-5	1-5

In the table 1, it shows that Layne and Lee [12] is not completely match with the proposed model. Stage 1 of Layne and Lee's model is the same as stage 1 of our proposed model, 5-stage model. Stage 2 of Layne and Lee's model is similar with stage 3 of 5-stage model. Stage 3 and 4 of Layne and Lee's model is similar with stage 4 of 5-stage model. In this case, the symbol X which means Not Applicable is put on stage 2 and 5 of 5-stage model.

Each of the models is compared with the proposed model, 5-stage model. It is categorized into five stages. Stage-1 is for one way information propagation. The information is coming from the government and it is distributed via internet to the society. The Stage-2 is for two ways interaction between government and society. It could be using the email or uploading question via web application. The Stage-3 is for transaction capability, especially in payment which needs interaction with banks or other financial institution. The Stage-4 is for integration between all government units vertically or horizontally. The Stage-5 is the advanced usage of data and information for public policymaking.

The table above is the summary for all discussed models, which are grouped into 5-stage model. The 5-stage model is categorized into Publish (Stage 1), Feedback (Stage 2), Transaction (Stage 3), Integration (Stage 4) and Policy (Stage 5). The stage 4 could be divided into two subcategories: Integration Internal (Stage 4a) and Integration External (Stage 4b). Stage 4a is for integration vertically in the same work unit and Stage 4b is between work units (horizontally). In figure 2, it shows that the stages of maturity growth are not inline. From Stage 1, it will not able to jump directly to Stage 3,

Stage 4 or Stage 5 directly without going through Stage 2. But on Stage 2, it could jump to Stage 4. The Stage 2 is the foundation for Stage 3 and Stage 4. Logically, before doing the transaction, it should have the capability of two way communications. The Stage 3 is the enhancement of Stage 2. In Stage 3, notification, confirmation or feedback is needed after the transaction. In Stage 4, the process of integration between two or more institution must have the two way communications. Transaction is not compulsory in the Stage 4. That's why, it could jump from Stage 2 to Stage 4 directly without through Stage 3. The integration means that all data and information are integrated into one system. It is the baseline for doing business intelligent for public policymaking in the next stage. The Stage 5 is the final stage as the process of public policymaking, which is integrated with the E-Government. Five criteria or indicators are provided to measure the status of each stage. The indicators are a combination between technical and non-technical aspects, such as: Leadership / Policy, IT Infrastructure, Information Processing (Application), Human Resources and Organization Culture [36].
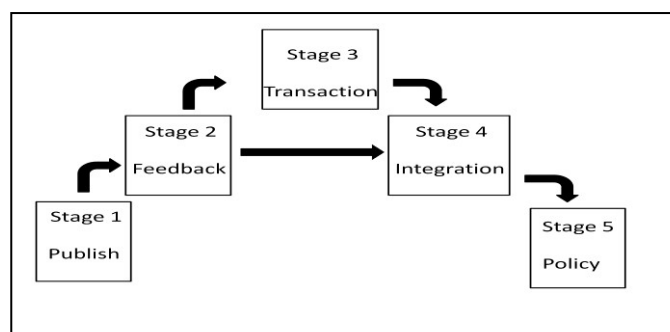

Fig. 2. The 5-stage model of E-Government Maturity Model (EEM)

The stages are:

- Publish (Stage 1),

At this stage, the objective is to give Data and Information in one direction from government to the public. It is published via internet. Leadership / Policy indicator shows that the individual activity is dominance. Self motivation capability is very important. The leader of organization has no interest or capability to utilize the IT for their organization. IT Infrastructure is setup to achieve one way communication only. Information Processing (Application) is not complicated. It is only a static web application to share the data and information to the public. A low skill human resource is needed to support a basic web server. In this stage, the data and information are kept and protected by each department or individual people.

- Feedback (Stage 2),

The objective in this stage is not only to give Data and Information to the public but also receive the feedback. It is supported by the Customer Relationship Management (CRM) System. The CRM is little bit difference with the one in the

private sector, but the main idea is the same. It is to increase the public satisfaction to the government.

Leadership / Policy to motivate others are dominant. The leader of organization has an interest to utilize IT. The Key Performance Indicators are introduced to support this. The IT Infrastructure is supported 24x7 to receive a feedback from public. There are some application suggested at this stage such as Email, Chat and Forum. More skillful human resource is needed, advance in technical and non-technical skill. Service oriented organization is a must. It is because the public is waiting for the action after they give the feedback.

- Transaction (Stage 3),

The objective is to give more services to public such as e-passport, e-licenses, e-payment and others. The transaction financial or non financial are inclusive in stage. The high security level is expected. The PCI DSS, ISO 27001 and ISO20000 / ITIL are considered to be implemented in this stage. Transparency is the key to monitor all business processes.

A dedicated head of Data and Information is needed to manage the operation and project. He/she needs capability to lead the IT group and report to the leader of organization. The IT Infrastructure needs to follow the international standard, especially in security to protect all transactions. The Application has the connection to Banks or Financial Institution for e-payment. Security engineer or expert is another requirement in this stage. Organization culture is to support transparency processes.

- Integration (Stage 4)

A government has many unit organizations, institutions, and departments. It spread over the country. It is very complex and tough challenge to collaborate them together. In this stage, the objective is the integration of all IT-related components in organization. It is not compulsory via stage 3. It could be happened after the stage 2 directly without development of stage 3. By jumping from Stage 2 to Stage 4, it speeds up the process, although it needs to make adjustment in the integration process. Many high skill project managers are needed in this stage to handle each project. For overall, the program or portfolio manager will oversee all projects and lead the function.

IT infrastructure needs more advance control tools such as ID Management, LDAP, Network Management Station (NMS), Policy Servers and others. The application has capability to be customized per profile by the public. It is dynamics web application. The system is more complex, and needs not only person expert in one field but also multiple fields, such as in Server, Network, Security and others. If all integrations run well, the effective and efficient processes will be achieved.

Some cases, the Stage 4 is divided into two sub stages. Stage 4a is for integration on the same department, work unit or institution. Stage 4b is for integration between departments, work units or institutions. Both of them have their own challenges.

TABLE II. INDICATORS OF E-GOVERNMENT MODEL IN 5-STAGE MODEL

No	Indicator	Stage				
		1	2	3	4	5
1	Leadership/ Policy	Self motivation	Motivate others	Lead group	Lead function	Lead organization
2	IT Infrastructure	1 way comm.	2 ways comm.	transaction	integration	Business intelligent
3	Information Processing (Application)	Static Web	Web with Email, Chat and Forum	Web with Payment capability	Dynamics Web with public data	Web with provided API
4	Human Resources	Basic capability*	Advance capability	Security capability	Complex capability	Analytics capability
5	Organization culture	Protection	Service	Transparency	Efficiency	Competition

*) capability in planning, execution and operation

- Policy (Stage 5).

This is the final stage which is the capability of e-government to support for public policymaking. The leader of organization needs to have a good vision and mission to utilize the Data and Information in their public policymaking. The head of Data and Information who reports to the leader of organization should be able support the leader's vision and mission. The IT infrastructure is design to maintain business intelligent application, such as Data Mining, Data Warehouse, Big Data, Data Analytic and others. The application supports to share data and information via API, such as JavaScript Object Notation (JSON) and Extensible Markup Language (XML) in the secured method. Human resource has the analytic capability to learn the data and information before feeding it into the system dynamics software application. It is expected that the competition becomes the culture in the organization.

D. Research Design

The objective of this new model of E-Government Maturity is to support the public policymaking. But, how to proof the relationship between them is another challenge. Fortunately, Nasution [8] provides a statistical validation based on Partial Least Square – Structural Equation Modeling (PLS-SEM) to learn the relationship between Public Policymaking (PP), System Dynamics (SD) and Big Data in

the E-Government. As the results of the analysis, System Dynamics (SD) explains 48% of variance in Public Policymaking (PP). E-Government Maturity explains 45% of variance in SD. Overall, the predictive power of factors is moderate or above the average. Therefore, the model gives an adequate predictive power for E-Government Maturity and System Dynamics in Public Policymaking. Next, the research design to evaluate the existing E-Government Maturity based on the proposed model is conducted.

The research is conducted by doing survey to some participant in one of National Application Workshop which is organized by one of ministry in Indonesia. The total respondents with the valid answers are 124. The respondent's profile is male (74%), well educated with university degree (89%) and located in west of Indonesia (56%). In the survey, the conditions of Leadership / Policy, IT Infrastructure, Information Processing (Application), Human Resources and Organization Culture [36] are questioned. Each question has 5 options of answer that will be used to determine the stage of EMM of each institution. The answer a is for stage 1. The answer b is for stage 2. The answer c is for stage 3. The answer d is for stage 4. The answer e is for stage 5. In general, the formula is

$$\text{Level of EMM} = \Sigma \, A_i.w_i \qquad (1)$$

Whereas i is to indicate the question 1 until 5, A_i is the answer of question i, and w_i is the weight or contribution of question i. The total w_i ($\Sigma \, w_i$) is 100%. In this paper, each answer contributes the same which is 20% (w_i) of the total answers.

The questions are for:

• Leadership / Policy

E1: The level or power of leadership in the department or organization to support Public Policymaking based on the data? (a. Self motivation or no leadership, b. Motivate others, c. Lead group or department, d. Lead function or division, e. Lead organization)

• IT Infrastructure

E2: The status of Information Technology Infrastructure (Network, Server and Storage) to support functionality in every business process, so that the Government can serve the society well ? (a. One way communication from Government to Society, b. Two ways communication between Government and Society, c. Secure Transaction or Payment is supported via online such as Credit Card and others, d. LAN and WAN Integration in organization to support the communication, e. Business intelligent is utilized)

• Information Processing (Application)

E3: The intensity of data and information processing for the benefit of Government and Society ? (a. Static Web, b. Web with Email, Chat and Forum capabilities, c. Web with Payment capabilities, d. Dynamics Web with public data, e. Web with provided API)

• Human Resources

E4: The expertise of Human Resources (SDM) in the department or organization is determined not only the technical operation of IT, but also Data Analytic capability? (a. Basic capability in operating single alone PC/Notebook, b. Advance capability in LAN, c. Security capability to maintain in the secured IT Infrastructure, d. Complex capability to integration LAN and WAN, e. Analytics capability to run Business Intelligent Application)

• Organization Culture

E5: How good and transparent organizational culture in the department or organization? (a. Protection, each of government employee keep their own data, b. Service, government serve the society, c. Transparency in conducting payment, d. Efficiency in communication between department, e. Competition to provide solution based on data)

The example of returned questionnaire is that if one of the respondents answer a for question 1, b for question 2, b for question 3, a for question 4, b for question 5, then the calculation is conducted based on equation (1) as below

$$\text{Level of EMM} = (1 + 2 + 2 + 1 + 2) \times 20\%$$
$$= 1.6$$

III. ANALYSIS

Based on the Survey, all respondents contribute equally to measure the EMM level of their organization. The result is below:

TABLE III. SUMMARY OF RESPONDENT'S RESPONSES

No	Respondents	Results	N
1	**Group 1**	1	9
2	**Group 2**	1.2	22
3	**Group 3**	1.4	49
4	**Group 4**	1.6	25
5	**Group 5**	1.8	1
6	**Group 6**	2.2	10
7	**Group 7**	2.6	5
8	**Group 8**	3.2	3

The average of the stage of EMM Level of this ministry between all groups becomes 1.54. The ministry is considered in the Stage 1. In this survey, only 14.5% of total respondents gives a higher (more than 2) stage of EMM Level.

IV. CONCLUSION

The proposed E-Government Maturity Model (EMM), which is called 5-stage model is valid to support System Dynamics (SD) for Pubic Policymaking [8]. By conducting the survey, the stage or level of EMM is identified

comprehensively. It is to know the level of Leadership / Policy, IT Infrastructure, Information Processing (Application), Human Resources and Organization Culture in the government [36].

One of the ministries in Indonesia has stage of EMM in the level of 1.54. It means the organization is not adopted the technology very well. Although, the head quarter of ministry in Jakarta has adopted a better E-Government, but unfortunately their work units in province and regency have not yet. Indirectly, it is impacted to the aims for ministry to run public policy effectively to the society [7]. Improvement of the level of EMM is positively related to the effectiveness of the implementation of public policy in the society [8].

Acknowledgment

References

[1] A. Fath-Allah et al, "E-Government Maturity Models: A Comparative Study," International Journal of Software Engineering & Applications (IJSEA), vol. 5(3), pp. 71 – 91, 2014.

[2] C. G. Reddick ,"A two-stage model of E-Government growth: Theories and empirical evidence for US cities," Government Information Quarterly, vol. 21(1), pp. 51–64, 2004.

[3] J. W. Forrester , "Industrial Dynamics," Cambridge, Massachusetts: The MIT Press, 1961.

[4] Gits, "The 3 Vs That Define Big Data (Volume, Velocity and Variety)", 2016. Available: http://gitsacademybangalore.over-blog.com/2016/03/the-3-vs-that-define-big-data-volume-velocity-and-variety.html (Retrieved on Sep 24, 2017)

[5] F.B.B. Nasution et al., "Big Data's Tools for Internet Data Analytics: Modelling of System Dynamics," International Journal on Advanced Science Engineering Information Technology (IJASEIT), vol. 7(3), pp. 745-753, 2017.

[6] A. Fitriansyah et al., "Metode Pemeringkatan E-Government Indonesia (PeGI) untuk Audit Tata Kelola Teknologi Informasi," Seminar Nasional Sistem Informasi Indonesia, Bali, Indonesia, 2 – 4 Dec 2013.

[7] F.B.B Nasution et al., "Conceptual Framework for Public Policymaking based on System Dynamics and Big Data," Proceedings of 2017 4th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI 2017),Yogyakarta, Indonesia, 19 – 21 Sep 2017

[8] F.B.B Nasution et al., "Public Policymaking Framework based on System Dynamics and Big Data," International Journal of System Dynamics Applications (IJSDA). vol. 7(4), 2018.

[9] Finn de Bri, "An E-Government Stages of Growth Model Based on Research Within the Irish Revenue Offices," Electronic Journal of E-Government. vol. 7(4), pp. 339 – 348, 2009.

[10] D. C. Misra, " Sixty years of development of e-governance in India (1947-2007): Are there lessons for developing countries?," Proceedings of the International Conference on Theory and Practice of Electronic Government, Macao, China,10 – 13 Dec 2007.

[11] M. Yildiz, "E-Government research: Reviewing the literature, limitations, and ways forward," Government Information Quarterly. vol. 24, pp. 646–665, 2007.

[12] K. Layne and J. Lee, "Developing fully functional E-Government: A four stage model. Government Information Quarterly," vol. 18(2), pp. 122–136, 2001.

[13] K. V. Andersen and H. Z. Henriksen, "E-Government maturity models: Extension of the Layne and Lee model," Government Information Quarterly, vol. 23(2), pp. 236–248, 2006.

[14] United-Nations, " UN E-Government Survey 2012: E-Government for the People," 2012. Retrieved on Sep 30, 2017 from http://unpan1.un.org/intradoc/groups/public/documents/un/unpan048065.pdf

[15] S. M. Alhomod et al.," Best Practices in E government: A review of Some Innovative Models Proposed in Different Countries," International Journal of Electrical & Computer Sciences, vol. 12(01), pp. 1–6, 2012.

[16] J. S. Hiller, and F. Belanger, "Privacy strategies for electronic government," E-Government, vol. 200, pp. 162–198. 2001.

[17] R. S. Almazan and J. R. Gil-Garcia," E-Government Portals in Mexico," 2008. Retrieved on Sep 30, 2017 from http://www.igi-global.com/chapter/electronic-government-concepts-methodologies-tools/9818

[18] Cisco IBSG, " e-Government Best Practices learning from success, avoiding the pitfalls, " 2007. Retrieved on Sep 30, 2017 from http://siteresources.worldbank.org/EXTEDEVELOPMENT/Resources/20080222_Phil_eGov_workshop.pdf?resourceurlname=20080222_Phil_eGov_workshop.pdf

[19] C. Baum and A. Di-Maio, "Gartner's four phases of e-government model," Gartner Group, 2000.

[20] D. M. West, "E-Government and the Transformation of Service Delivery and Citizen Attitudes," Public Administration Review, vol. 64(1), pp. 15–27, 2004.

[21] M.J. Moon,"The Evolution of E-Government among Municipalities: Rhetoric or Reality?," Public Administration Review, vol. 62(4), pp. 424–433, 2002.

[22] Y. Toasaki," e-Government from A User's Perspective," APEC telecommunication and information working group, Chinese Taipei, 2003.

[23] Deloitte & Touche, "At the dawn of e-government: The citizen as customer," New York: Deloitte Research, 2000. Retrieved from on Sep 30, 2017 http://www.egov.vic.gov.au/pdfs/egovernment.pdf

[24] M. Howard, " E-Government across the globe: how will'e'change government," E-Government, vol. 90, pp. 80, 2001.

[25] K. A. Shahkooh et al., "A proposed model for E-Government maturity," 2008 3rd International Conference on Information & Communication Technologies: from Theory to Applications (ICTTA), Damascus, Syria, 2008.

[26] G. Lee and Y. H. Kwak, " An Open Government Maturity Model for social media-based public engagement," Government Information Quarterly, 2012. Retrieved on Sep 30, 2017 from http://www.sciencedirect.com/ science/article/pii/S0740624X1200086X

[27] K. Siau and Y. Long, "Synthesizing e-government stage models–a meta-synthesis based on metaethnography approach," Industrial Management & Data Systems, vol. 105(4), pp. 443–458, 2005.

[28] C. G. Wescott, "E-Government in the Asia-pacific region," Asian Journal of Political Science, vol. 9(2), pp. 1–24, 2001.

[29] S. Chandler and S. Emanuels, "Transformation not automation," In Proceedings of 2nd European Conference on E-Government, St Catherine's College Oxford. UK, 1 – 2 Oct, 2002.

[30] D-Y. Kim and G. Grant, " E-Government maturity model using the capability maturity model integration, " Journal of Systems and Information Technology, vol. 12(3), pp. 230–244, 2010.

[31] J. Chen, Y. Yan and C. Mingins, " A Three-Dimensional Model for E-Government Development with Cases in China's Regional E-Government Practice and Experience," 2011 Fifth International Conference on Management of e-Commerce and E-Government (ICMeCG). Wuhan, Hubei, China. 5 – 6 Nov 2011.

[32] P. J. Windley, "eGovernment maturity," USA: Windleys' Technolometria, 2002. Retrived on Sep 24, 2017, from http://www.windley.com/docs/eGovernment%20Maturity.pdf

[33] S. J. Rohleder and V. Jupp, "E-Government Leadership: Engaging the customer," Accenture. 2003. Available : https://www.eldis.org/document/A12464 (Retrieved on Jan 30, 2018)

[34] NAO," Government on the Web II," 2002. Retrieved Retrived on Sep 24, 2017, from http://www.nao.org.uk/publications/0102/government_on_the_web_ii.aspx

[35] I. Netchaeva," E-Government and E-Democracy A Comparison of Opportunities in the North and South," International Communication Gazette, vol. 64(5), pp. 467–477, 2002.

[36] Achmad Nizar Hidayanto, Yulia Razila Ningsih, Puspa Indah Sandhyaduhita, and Putu Wuri Handayani, "The Obstacles of the E-Government Implementation: A Case of Riau Province, Indonesia," Journal of Industrial and Intelligent Information, vol. 2(2), pp. 126-130, June 2014.