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Measuring the e-Government Maturity in Indonesia using the Ranking of e-Government of Indonesia (PeGI)

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Abstract

In rapid development of Information Communication and Technology (ICT), citizens need fast and easy-to-access regarding e-Government services. To fulfil the requirements, Indonesian Government has been developed and implemented e-Government services in both local and central government. However, to measure the e-Government success, there is a model to measure the ranking of e-Government in Indonesia named PeGI. The measurement is applied to ministry, non-ministry government, and local government institution. This paper aims to measure e-Government development and implementation in a Ministry institution in Indonesia. The measurement model divided e-Government into 4 dimensions; policy, institutional, infrastructure, application, and planning. The result of the measurement indicated that the Ministry has 3.37 out of 4 and it belongs to good rating. Further in this paper, we also give recommendations to improve the e-Government development and implementation in the Ministry in order to deliver better services to citizen and other partners.

Keywords: e-Government ranking; e-Government; Indonesian Government; PeGI; e-Government success.

1. Introduction

In the rapid development of information and communication technology (ICT), people have increased their dependency into ICT. This phenomenon is the effects of the needs of fast and easy-to-access to information and services. In order to satisfy the needs, electronic government (e-Government) services should be applied to Government to deliver fast and easy-to-access government services [1–3].

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The use of internet improves the services delivery by using modernization of the internet [2]. The term of e-Government refers to an approach that resembles to enhance government services and create tools to connect between government to citizen,

business, and partner through electronic media [4]. The use of electronic media to deliver such services is expected to create better and faster access to government's services [5].

One of the strategies to deliver better and faster services is by applying e-Government implementation, Nowadays; e-Government has been adopted by most countries including Indonesia. As a developing country, Indonesia has created a regulation regarding e-Government policy and national strategy written in The Presidential Instruction No 3 of 2003 [6]. This regulation straightens up the e-Government development and implementation in an entire government institution in Indonesia [6,7]. The aims of e-Government implementation in Indonesia is to increase the Government services to a citizens using ICT [6]. To ensure the organization success of e-Government development and implementation, a national map of ICT implementation in government institution is needed [8]. In Indonesia, a model to rank e-Government development and implementation had been created to assess e-Government in a governments institution. The model is named the ranking of e-Government of Indonesia (PeGI) [9]. The assessment of e-Government implementation also gives the standard to ICT development and implementation within a government institution. The assessment can also be used to see the e-Government maturity which in the government institution [10].

E-Government ranking has been conducted in Indonesian's ministry, local government, and non-ministry government institution. The process of e-Government ranking is managed my Ministry of Communication and Information technology by inviting e-Government expert and took several steps of assessment. In the end of the assessment, the Ministry of Communication announces the e-Government ranking for each assessed government institution. This paper will explain about the measurement of Indonesian's e-Government ranking in a Ministry in Indonesia. The aim of this paper is to explain the e-Government ranking process by identifying the current condition of ICT in the selected Ministry. In addition, it also gives recommendations for further e-Government improvement. This research is limited to only measure the e-Government maturity in a Ministry in a case study and the recommendations are arranged based on our analytics only.

2. Materials and Methods

Indonesian Government has developed a framework that is used to measure the development and implementation level of e-Government institution in Indonesia. It is called the ranking of e-Government of Indonesia (PeGI) [7]. PeGI was developed and maintain by the Directorate of e-Government, the Directorate General of Telematics Applications, Ministry of Communication and Information Technology (Ministry of Kominfo) [11]. The minister of Kominfo issued a policy The Ministerial Circular No. 07/SE/M.KOMINFO/10/2011 which tells that PeGI was developed to increase the efficiency and effectiveness of ICT in government institutions [7]. The PeGI evaluation for each government institution is held in periodic time. There are three purposes of PeGI, including [9]:

a) Provides reference to developing and implement ICT in government institution
b) Support the increasing of ICT implementation in government institution using a holistic, balance, and objective measurement
c) Create a national map of ICT implementation condition in a government institution.

The framework can also be used as a guideline to lead, develop and implement ICT in government institution [11]. This can support both central and local the government institution to improve the quality of performance in order to accomplish good governance [12]. To rank e-Government development and implementation, PeGI has five dimensions including policy, institutional, infrastructure, application, and planning [13]. Each dimension has an equal weight value in the assessment process because all dimensions are interrelated and mutually supportive [9].

1) Policy

This dimension assesses whether there is a policy in government institution related to ICT implementation and e-government application [6]. The policy context means a way that covers law, regulations, strategy declarations, work practice goals, and any other valued government statements [15]. In Indonesian Government, the institutional policy is the base case for e-Government development and implementation. The policy assessment is conducted by evaluated the policy that consists of official documents that have legal force. Such documents consist of the determination of direction/purpose, working program, ordinance, or regulation of e-Government development and implementation in the assessed institution. The documents may form as regulations, guidelines, and other forms of official documents. The other indicator of policy is the financial support to develop and implement ICT.

The questionnaire for this dimension was developed to identify issues related to laws and any official documents that provide direction and foster the use of ICT in an organization (e.g., vision and mission statements, strategy for utilizing ICT, standard operating procedures, guidance, regulation and budget policy). This questionnaire contains seven indicators, including policy formulation, vision and mission statement, ICT implementation strategy, guidance, regulation, provision of agency officials, risk management, priority scale, and audit processes.

2) Institutional

The institutional dimension relates to the existing organization or department in its internal institution that has responsibility for managing ICT within institution [6]. The institutional assessment evaluates the following area:

- The existing structural organization is complete so it can perform the ICT governance, development, operation, services, and any other functions.
- The existing documents that describe a clear statement about role and functions.
- The existing adequate working unit and its human resources that support the ICT development and implementation based on quantity, competency, career path, or employment status.

- Existing adequate authority so the institution can perform its role and function including control and supervision of ICT development and implementation in the institution.

The questionnaire for this dimension was developed in order to identify issues related to the existence of the organization, which is authorized and responsible for the development and utilization of ICT infrastuctures. For examples, complete orga-nizational stucture (there is CIO, technical support function, etc.), the clarity of duties and function, completeness of units and apparatus (e.g., their number, level of competence and status), and legality or legal basis. This questionnaire contains five indicators, including the existance of the organization, duties, and functions of ICT management unit, standard operating procedures, human resources, and human resources development.

3) Infrastructure

The other dimension of PeGI assessment is infrastructure related to supporting facilities in ICT development and implementation [6]. This dimension evaluates certain areas, including:

- Data center which evaluates both hardware and software that is used by the data center.
- Communication network including LAN, WAN, and internet access
- Hardware and software that used by the users on their personal computers.
- Service delivery channel in several forms, such as website, telephone, short messaging service (SMS), etc.
- Any other supporting facilities such as AC, UPS, generator, etc.

The questionnaire for this dimension was developed to identify issues related to the infrastucture necessary for the development and utilization of information technology (e.g., server, personal computer, data network, operating systems, a database application, and any supporting facilities including printer, scanner, AC, electricity, access control, etc.). This questionnaire contains seven indicators, including data center, data network, security, supporting facilities, disaster recovery, ICT maintenance, and ICT equipment.

4) Application

The application dimension evaluates related to the availability and usability of e-Government services software and application [6]. The application should support e-Government directly or indirectly. The implementation of e-Government application must perform e-Government function based on the institution role and function. There are application groups that can be assessed, including [6]:

- Services application
- Administration and management application
- Legislative application
- Development application
- Financial application

- Human resources (employee) application
- Government administration application
- Territory management application
- Society application

The questionnaire for this dimension was developed to identify issues related to the availability and utiliation level of supporting software and applications of e-government in accordance with the institutional duties and functions. This questionnaire contains nine indicators, including homepages, service application, administration and management applica-tion, legislative and development application, financial appli-cation, human resource (employee) application, functional application documentation, ICT tools, and equipment docu-mentation, and interoperability.

5) Planning

The last dimension of PeGI assessment is government planning related to the integrity and sustainability of ICT governance and management planning [6]. The evaluation assesses the following area:

- Existing planning process to develop and implement ICT in real
- Existing study about the requirement and ICT practice strategy that consists of goals, benefit, a map of current condition, technological option, etc.
- The existing implementation of decision making and the realization of ICT development based on the development planning.

The questionnaire for this dimension was developed to identify issues related to the institutional ICT strategic planning. This questionnaire contains six indicators, including existing planning function, ICT planning arrangement, master plan, roadmap, documentation, and ICT budget.

This research conducted in the Ministry of the Transportation Republic of Indonesia. We used a purposive sampling technique to select the respondents. Purposive sampling defined as a sampling technique that determined by us based on the personal competence of the respondents. We chose the respondents by considering their deep knowledge of the ICT governance and implementation in the institution.

In this study, we chose respondents from ICT management unit at the Ministry, named Center of Information Technology and Communication (Pustikom). The respondents were requested to fill the questionnaire. To make sure that the answer to the questionnaire was valid; they must provide any evidence and documentation. There were 3 respondents that participated in this research based on their own specialty (system analyst, network security, and programmer).

Assessment process of e-Government ranking in the Ministry is conducted as follow [3]:

- After all of the questionnaires are filled and equiped with supporting information, assessors will check that information to ensure its validity;

- Assessors will provide assessment and rating for each dimension (policy, institutional, infrastructure, application, and planning) based on the answers and information from respondents.

For each indicator in the five dimensions, we give a score based on the actual e-Government implementation. The score differs from 1 to 4 which higher score is better. The final dimension measurement score is produced by averaging the indicators score. The final e-Government assessment score is produced by averaging the five dimensions score. The guideline for assessing e-Government using PeGI is shown in Table I.

Table 1: Assessment Guidelines

Score	Meaning (x)	Description
$1 \leq x < 1.6$	Very poor	Not available
$1.6 \leq x < 2.6$	Poor	In planning
$2.6 \leq x < 3.6$	Good	Available but not complete
$3.6 \leq x < 4$	Very good	Available and complete

The "very poor" score given for indicator that was not implemented and it has no basic policy regarding the indicator. The "poor" score indicates that the institution is in the planning process to implement the measurement indicator. The planning process is either constructing or partially implement the indicator activity. To achieve this score, the institution must provide documented evidence (such as meeting notes, online or offline news, memos) that they are planning or working in related indicator activity. The "good" score is given for partially implemented or not completed measurement indicator. The partial implementation means that the institution has implemented it in several areas of work, but it has not covered all areas or work. The highest rating for the measurement is which means that the institution has fully implemented the measurement indicator in entire institution

3. Result

The e-Government ranking assessment was conducted by following PeGI measurement methodology. This section explains the result of PeGI measurement model in five dimensions. In addition, we also provide the discussion related to the result. Based on the methodology that we applied to the measurement, we achieve the result of PeGI score for each dimension. The PeGI score for each dimension came from averaging its indicators' score. The explanations below are described the result of PeGI measurement for each dimension based on its indicators.

1) Policy

The policy dimension has nine indicators in which differ from the policy formulation until audit process. We gave a score for those indicators based on the real condition of ICT management and implementation in the

Ministry. The result of policy assessment is shown in Table II.

Table 2: Policy dimension assessment

No	Indicator	Score
1	Policy formulation	4
2	Vision and mission statement	4
3	ICT implementation strategy	4
4	Guidance	4
5	Regulation	4
6	Provision of agency officials	4
7	Risk management	3
8	Priority scale	4
9	Audit process	3
Total		34
Average		3.78

Based on the policy assessment, the overall score for the dimension is 3.78 and it belongs to very good rating. In the policy formulation, the Minister and supreme leader in the institution have been directly involved. As the ICT utilization is stated in the Ministry's vision and mission, the Ministry created several ICT related strategies, guidance, and regulation. In the ICT master plan, the institution has created ICT scale prioritization which application development has the highest priority. However, risk management and audit have not been completely implemented within the institution.

2) Institutional

The assessment on institutional dimension of M e-Government within institution focuses on existing organization in the ministry that has authority and responsibility for ICT development and utilization. There are five indicators that supporting institutional dimension as shown in Table III.

Table 3: Institutional dimension assessment

No	Indicator	Score
1	The existance of organization	4
2	Institutional duties and functions	4
3	Standard operating procedure	3
4	Human resources	3
5	Human resources development	4
Total		18
Average		3.60

Based on the institutional assessment, the overall score for the dimension is 3.6 and it belongs to very good rating. ICT management in the Ministry is managed by Pustikom which has four sections including the area of planning and policy, application development, data management and operational, also administration. Each section has clear responsibility and functions as it stated on the regulation. For the operational duties, it has several supporting standard operating procedures. The Pustikom is supported by 28 personnel which most of them have ICT education background. To ensure the quality of its personnel, Pustikom gives several ICT related training for their employee.

3) Infrastructure

The infrastructure assessment evaluates the quality of existing e-Government hardware and infrastructure. Besides that, it also evaluates the supporting regulation and documentation regarding infrastructure implementation. It has seven indicators as shown in Table IV. The result of this assessment on the Ministry is shown in Table IV. Based on the infrastructure assessment, the overall score for the dimension is 3.00 and it belongs to good rating. The Ministry has the adequate infrastructure needed to implement e-government including data center, data network, and any supporting facility. The infrastructure is working as intended and capable of supporting e-government application to some extent. However, the management of this infrastructure is still lacking as they still have two separated data centers, many different vendors to maintain equipment and no backup internet connection. In addition, the implementation of ICT security is insufficient to protect their data and infrastructure.

Table 4: Infrastructure dimension assessment

No	Indicator	Score
1	Data center	3
2	Data network	3
3	Security	2
4	Supporting facilities	4
5	Disaster recovery	3
6	ICT maintenance	3
7	ICT equipment inventory	3
Total		21
Average		3.00

4) Application

The application assessment evaluates the quality of existing e-Government services software and application. This assessment does not only evaluate an external application that can be accessed outer institution but also evaluates the internal application that supports the Ministry main process. It has nine indicators as shown in

Table V. The result of this assessment on the Ministry is shown in Table V.

Table 5: Application dimension assessment

No	Indicator	Score
1	Homepages	4
2	Service application	4
3	Administration and management application	3
4	Legislative and development application	3
5	Financial application	4
6	HR (employee) application	4
7	Application documentation	4
8	Application inventory	3
9	Interoperability	4
Total		33
Average		3.67

Based on the application assessment, the overall score for application dimension is 3.67 and it belongs to very good rating. The Ministry has all application needed that can be accessed towards the institution's homepage to implement e-Government service. The institution homepage is updated regularly to gives public information, so it can support faster, better, and transparent of public services [16].

The government services can be obtained by accessing online service applications. To support internal process, the Ministry also has applications related to finance; human resources; electronic mail; etc. The applications are well documented and maintained. The also had implemented interoperability so that their data is integrated well. The interoperability is supported by Service-Oriented Architecture (SOA) which transfer of institutional data between institutional units [17].

5) Planning

The last dimension of PeGI is ICT planning. This dimension assesses the ICT governance and management in the organization. There are six indicators that support the evaluation as shown in Table VI. The result of ICT planning assessment on Ministry of Transportation is shown in Table VI below.

Based on the planning assessment, the overall score for planning dimension is 2.83 and it belongs to good rating. The ICT planning in the Ministry is managed by a functional area named ICT planning section which is arranging IT master plan. It has ICT roadmap but it is not complete and the work plan is not documented. The other issue is the ICT budget realization is smaller that was written on the ICT planning, so it cannot support all ICT aspects in the institution [18].

Table 6: Planning dimension assessment

No	Indicator	Score
1	Existing planning function	4
2	ICT planning arrangement	4
3	Master plan	2
4	Roadmap	3
5	Documentation	1
6	ICT Budget	3
Total		17
Average		2.83

4. Discussion and Recommendation

Based on the result of e-Government assessment for each dimension, Ministry of Transportation has very good score the overall scores in policy and application, and a good score for institutional, infrastructure, and also planning.

To improve the current e-Government implementation, we also presented recommendations that potential to be applied in the institution. Based on the five dimension of PeGI, we calculate the overall e-Government score for the ministry. Table VII shows the result of the overall assessment. The overall score for PeGI in Ministry of Transportation is 3.37 and it belongs to good.

Table 7: Overall evaluation of PeGI score

No	Dimension	Score
1	Policy	3.78
2	Institutional	3.60
3	Infrastructure	3.00
4	Application	3.67
5.	Planning	2.83
Average		3.37

Based on the overall evaluation of e-Government development and implementation, the PeGI score of Ministry of Transportation is 3.37.

The score belongs to good rating because it stands between 2.6 and 3.6. The resume of PeGI score based on a comparison of the five dimensions is also shown in radar chart in Figure 1.

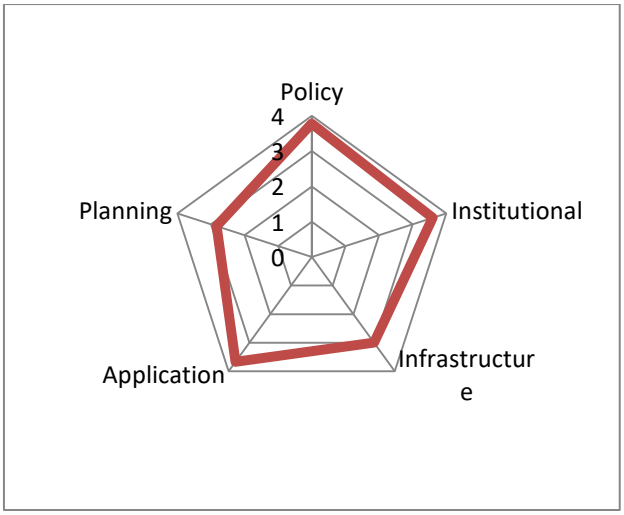

Figure 1: Radar chart for e-Government ranking score

Based on our research, the planning dimension is the lowest score. The policy planning process is an essential to process because it can increase the performance in public service delivery and outcome achievement [19]. In the ministry, this function was conducted by policy and planning area of work. However, the area is still new because it was established in a year later and still has a lot of tasks to do. In addition, the institution is still arranging the ICT Master Plan and ICT Blueprint. Those planning documents are important for developing e-Government in the institution as it contains set of principles to guide the e-Government development [20]. In addition, it also contains e-Government vision for each business units. So, the guidance can be used by the institution leaders to make decision and choice for pursuing e-Government [20].

The second lowest score is infrastructure. As the main hardware and physical support of e-Government, the infrastructure plays an important role in the success of e-Government [21]. The supporting infrastructure in the ministry is complete but it has low security aspect. This happens because there is no information security policy and regulation. However, Pustikom is arranging policy regarding information security management (ISM) [22], [23]. In addition, the infrastructure has not managed well as there is no infrastructure assets management. The better infrastructure will improve the e-Government implementation as infrastructure also plays essential roles in supporting e-Government interoperability and IT systems integration [24].

Otherwise, the highest dimension is policy with the very good rating. The policy plays great roles as it is the main fundamental e-Government implementation in the organization and it has a powerful effect on the institution activity [25]. The ministry has an almost complete policy regarding ICT aspects to the entire institution. The policy and regulation cover several aspects, including ICT strategic, priority, guidance, etc. In government institution, policy and regulation are the basic and formal norm for creating improvement [26].

The institutional dimension has a high score because it has a centre of ICT within organization named Pustikom. It is supported by employees which most of them have ICT background. The ministry gave several IT training to develop its human resources. The Ministry aware that the human capital development can empower and improve the quality of employees' competency [6,27]. IT also has standard operating procedure regarding ICT

although it is not complete. The institutional plays important roles in the success of the e-Government implementation as it provides fundamental e-Government organizer within institution [28].

Since the application in the ministry is almost complete, this dimension has a second highest score. The ministry has a lot of application not only services but also for internal use application. To manage the application, it supported by certain policy regarding application management and utilization. In addition, the institution is going to integrate all the application and data to support interoperability [28]. So, in the future, the institution's data can be used by other institutions in order to provide better public services to the citizen [29]

The Ministry has a good score of e-Government ranking. However, they can improve their achievement by enhancing several aspects, especially in Pustikom. We have listed recommendations based on our finding that can be applied in the ministry as below:

1. Conducting risk management and audit for every ICT development and implementation within the institution. Risk management is important to predict possible future failure and to prioritize the necessary IT related activities in the institution. The audit is an important process in order to create better governance within institution [26]. These activities can increase the ICT performance in the institution because they can minimize the risk effect as early as possible. In addition, by conducting regular IT audit in the organization, they can discover any discrepancy or failure between the planning and implementation. Then, an audit can increase the effectiveness of risk management and it can control the IT governance within institution [26].
2. Enhancing security management that covers data, information, and network security. By using security management, the institution can protect their information and assets to prevent any security abuse by irresponsible parties [23]. One of the methods to implement security is by using Information Security Management (ISM). The ISM can be conducted by creating information security supporting action such as policy, processes, procedures, and organizational structure [23]. In addition, the institution should improve the implementation by reviewing the information security support and manage the ISM process including planning, implementing, monitoring, and improving information security activities [23]. By applying ISM within e-Government implementation, the institution also protects citizens or other organizations stored data privacy and security [22,30].
3. Manage infrastructure by creating standard operating procedures, equipment inventory, and maintenance schedule. The infrastructure management can help the institution to provide documentation and maintenance while tracking any changes. In addition, the infrastructure management can help the institution to make internal audit regarding its infrastructure [26]. To support better transportation services to all Indonesian area, which has the extraordinary geographic area, the infrastructure should be investing continuously and briefly in order to receive the maximum infrastructure utilization [21].
4. By the time being, the Ministry is revising the previous master plan for IT because the regulation has been changed. So, finishing the revised ICT Master Plan and ICT Blueprint in the institution is necessary. Those documents are the fundamental guidance for the e-Government implementation in the institution [20]. The masterplan roadmap should contain the clear e-Government goals that should be

achieved in the implementation [21]. In addition, it also needs a complete roadmap that covers ICT with the exact time and business units' goals. The master plan roadmap can help the institution to pursue the increase of the e-Government maturity [21].

The recommendations above are expected to help the institution to enhance their e-Government development and implementation. The purpose of this improvement is to deliver better and faster services to the citizen or other parties.

3. Conclusion

The Ministry of Transportation has PeGI score of 3.37 out of 4 which belongs to good rating. In general, the e-Government development and implementation in the ministry are good. The best aspect is it has a complete policy regarding ICT. It also has good application and institutional aspects. Henceforward, the infrastructure and planning function should be enhancing to maximize the e-Government development and implementation.

Based on the PeGI measurement result, we proposed some recommendations that can be applied to the Ministry of Transportation. We expected that it can be used to enhance e-Government development and implementation within the institution. Then, Ministry of Transportation can deliver better and faster services in the area of Transportation in Indonesia. The recommendations are to improve four areas, including risk management and audit, security management, infrastructure management, and master plan reviewing.

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