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E-gov Readiness Assessment to Determine E-Government Maturity Phase

Aji Supriyanto, Khabib Mustofa
Department of Computer Science
Gadjah Mada University
Yogyakarta, Indonesia
ajisup@gmail.com , khabib@ugm.ac.id

***Abstract*—Many models were developed to assess E-government (E-gov) readiness, as well as E-gov maturity phase or level models that are becoming 'benchmark' today. Each model has strengths and weaknesses. This paper reviews various E-gov readiness and maturity phase assessment models, conducted by previous researchers. The methodology applied was review to some journals and comparing them with various E-gov readiness and maturity phase assessment models. Furthermore, aspects or domains of readiness assessment were identified and components of every framework aspect were determined. Later, the content limitations of each E-gov maturity phase will be identified. Analysis was conducted by creating a matrix to determine the relationship between every E-gov readiness assessment aspect and E-gov maturity phase. The value of each E-gov maturity phase can be determined by calculating the average of total E-gov maturity value meeting E-gov maturity phase. The results can be used as a benchmark and evaluation for decision-makers to be able to determine the next steps for the improvement of E-gov maturity level or phase.**

Keywords— assessment; readiness; phase; maturity; e-gov.

I. INTRODUCTION

The worldwide e-government (e-gov) development has passed many different phases. With comparable measurement, many developing countries are still in the early phase of development compared to the developed countries [1] [2]. It can be seen from E-gov annual benchmarking by several international institutions. The information readiness and availability is important to improve E-gov policies and strategies[3], especially in developing countries [4].

The adoption and diffusion obstacle of E-gov services can be solved depends on the country readiness on ICT infrastructure and distribution [5]. Government's efficiency, transparency and accountability could be improved exploiting the ICT potential [6]. It may lead to cost saving and service improvement [7]. Here, the target and objective achievement depends on applied phases. It requires an assessment for determining E-gov development level or phase. To identify the development, it requires an assessment that can be used as a guide in determining E-gov development level or phase. Thus, E-gov readiness and maturity level can be determined [7].

E-gov Readiness Assessment (ERA) is an important step in an effective and strategic policy and decision-making [3], [8]. This evaluates E-gov development in a country, city or specific government agencies. ERA is effective instrument to carry out the planning, monitoring and initiating evaluation towards an information society and particularly E-gov [9], For developing countries with various public service problems [8].

One of the main problems is public access opportunity, because E-gov readiness is not only limited to government institutions [1], but other public sectors. Fulfillment of Information and Communication Technology (ICT) access requires the development of modern infrastructure and shall be affordable for all communities. It becomes the real gap in ICT access between developed and developing countries [6].

Readiness assessment method has been performed by using a variety of different assessment indicators and different focus [10]. However, most applied methods being used have poor quality and fragmented measurement efforts [11]. Focus on the methodology and survey design [8]. For example on research of [5], it only focused on discussing about ICT readiness dimensions for e-gov, and did not discuss about other aspects.

Among many assessment instrument, the widely used assessment instruments are UNDESA, Waseda University, Accenture [3] [8], Brown University and SAR Macau. However, each has its own focus [8]. Similarly, Reference [12] and [10] have identified 25 E-gov maturity models. However, each maturity model has different focus. Reference [2] identifies and summarizes 9 E-gov maturity models.

The main challenge in the E-gov development is the ability and readiness of management, players, market mechanisms that slow the penetration and utilization of information network infrastructure for government, business, public service activities, as well as community activities. The presence of regions and social groups that are difficult to get commercial information network services is a challenge that must also be faced [13]. For that reason, this paper will provide a review on various readiness assessment tools. This paper will summarize the review results to determine their relationship with E-gov maturity level. In which on national scale is most likely be applied in developing countries.

II. LITERATURE REVIEW

E-gov has several definitions, depending on the usage focuses. However, many common definitions are adopted from UN, World Bank, OECD, and the European Commission, which essentially involve the use of ICT to improve the delivery of government services and to improve the government operations.

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Thus, implicitly, the definition of e-government includes three aspects, namely government-to-citizen (G2C), business (G2B) and inter-government (G2G) [7]. E-gov according to the [11] is defined as the use of information and communication technology (ICT) and its application by the government for the provision of basic public information and services to the community. Meanwhile, one of the latest definitions by [10] which states that E-gov is the use of ICT to improve public services in order to increase the government's relationship with its employees, citizens, business or internal structures to ensure the efficiency and effectiveness in government or with other governments [10].

Readiness in relation to E-gov can be defined as the ability of government to use ICT in transferring services and activities into a new environment. Reference [14] defines e-readiness as the extent to which a country, a nation or an economy may is ready, willing or prepared to obtain the benefits that arise from ICT. In applying ICT for effective use, it shall also prepare the supporting instruments such as infrastructures, ICT accessibility for society in general, and the effects of legal and regulatory frameworks on the use of such ICT. The evaluation criteria must come 'from the field' which has been established [4].

In the context of E-gov implementation by [15] E-gov readiness is defined as a function of a country in preparing ICT network, infrastructure, access at citizen level to electronic services, and the presence of government security policies and mechanisms. This step is often used to measure the readiness of a country to take part in the electronic activities such as e-commerce and e-government. In most cases, E-gov readiness is represented by an index [4]. Reference [11] describes that E-gov Readiness Index is a composite measurement to a country capacity and willingness to use ICT in the development of e-gov. Along with the assessment of website development pattern in a country, E-gov readiness index combines the characteristics of access, such as infrastructure and education levels, to reflect how a country uses ICT opportunities for national, economic, social and society empowerment cultures.

The purpose of readiness assessment is to provide basic data, advanced data and all information required for the development of E-gov strategy to fulfill the national development, and continuous implementation as well as monitoring systems [8]. In order to achieve the said purposes, it must involve planning to identify the skills and needs using quantitative and qualitative assessment [16]. Hence, the aim of E-gov in government management is providing efficient information, better public services, and community empowerment through access to information and participation in public policy decision making[11][16][10]. Meanwhile, the outcome of E-gov readiness assessment is E-gov readiness index. Hence, E-gov readiness index is a composite index consisting of Web size index, Telecommunication Infrastructure index and Human Capital index [11]. However, the index represents only one of the existing standard [3].

E-gov readiness assessment provides important knowledge to make policy and to take decision. This is performed after ICT strategy of E-gov organization is set [8]. In addition, e-readiness assessment allows government to regulate, measure and achieve realistic purposes for E-gov Readiness (EGR)[17]. It is important to develop and perform e-readiness assessment so that the result can be utilized to catalyze measures, to improve global competitiveness, and to employ the limited resource wisely. E-gov readiness assessment needs to examine the key dimensions of E-gov environment in order to help decision-making, to identify measure priorities, based on national readiness level and development strategies [8].

E-gov is applied continuously and the development are drafted gradually [16] to reach a more mature level. Maturity models have been introduced by [18], which saw E-gov as an evolutionary phenomenon, E-gov initiatives should be initiated and executed. They considered four phases of E-gov growth model: (1) cataloging, (2) transaction, (3) vertical integration, and (4) horizontal integration. While the five factors important for the successful implementation of E-gov services include political commitment to reformation process, the availability of ICT infrastructure, institutional capacity, the underlying legal framework relating to electronic administration and, no less important is, E-gov strategic planning [7]. This is an important foundation in E-gov readiness assessment. E-gov planning methodology consists of four phases: Strategic Planning, measuring or assessing readiness, Implementation Planning and E-gov Planning [1].

Study on the factors determining E-gov readiness has used by the United Nation (UN) Survey, International Telecommunication Union (ITU) E-gov development Index (EGDI); and Economist Intelligence-Digital Economy (EIDE) [10]. In similar with E-gov maturity, at least 25 different E-gov maturity models [12] performed and resulted four E-gov maturity phases. E-gov portal maturity model is set of evolution phases that determine the maturity of E-gov portal. The maturity model offers a method to rank E-gov portals and institutions as a guide to improve the portal quality [17].

Reference [17] uses e-Government' Best Practice Model (eGPBPM) to study 25 best E-gov maturity models [17]. Reference [12] has also successfully compared the 25 E-gov maturity models to find their similarities and differences as well as to identify their weaknesses and strengths. Despite the maturity model presents a great similarity among them, the research findings indicate that the features included in a model are different from in other maturity models. Study was conducted with government, holistic, and evolution approach models. The results of this study is to determine the most important phases in E-gov maturity which includes presence, interaction, transaction, and integration [12].

Reference [2] with qualitative meta-synthesis approach was used to compare 9 E-gov maturity models focusing on the technology used at each phase. The phases are almost identical to model standard of Gartner [19], i.e. consisting of Presence, Interaction, Transaction, and Transformation. The Model of [18], i.e. cataloging, Transaction, vertical integration, and horizontal integration. Organization maturity models utilizing ICT has assisted organizations in improving the quality of products such as software, one of methods that can be applied is systematic literature review (SLR).

III. METHOD

With the emergence of various E-gov readiness and E-gov maturity assessment models, it is necessary to study the existing models to determine the choice of appropriate instruments in the implementation of E-gov nationally. This paper will discuss the results of review on several E-gov readiness assessment models. Furthermore, it will also discuss the result of review on E-gov maturity models that are appropriate in the implementation of E-gov at national government level in a country, especially for developing countries. E-gov development model starts from the readiness phase to determine E-gov maturity level. The method used to determine readiness assessment and maturity phase is descriptive analysis. While the method for determining the readiness assessment aspects to E-gov maturity phase is Stage Maturity Model (SMM).

The activity phases are reviewing some relevant journals mainly on the result of review on E-gov readiness and maturity assessment. Then, the next phase is identifying the domain or aspect of E-gov readiness assessment including components on each of these aspects. Such aspects and elements are organized into a E-gov readiness assessment framework which becomes the basis for determining the E-gov maturity phase. The next step is applying SMM method to E-gov maturity. It is performed by identifying the results of review to the comparison of various E-gov maturity models. The result of review is in the form of identification to predetermined E-gov maturity phase the similarities, differences, weaknesses and strengths. Then, selection was performed by determining the completeness, strength and compatibility with the E-gov readiness which is taken from the summary of study by [12].

The identification results of E-gov readiness and maturity assessment is then analyzed by forming a matrix to determine the relationship between aspects of readiness assessment with E-gov maturity phase. From such matrix, a value can be generated that can determine E-gov maturity level or phase based on E-gov readiness. The resulted value is derived from each E-gov maturity phase which the value is predetermined.

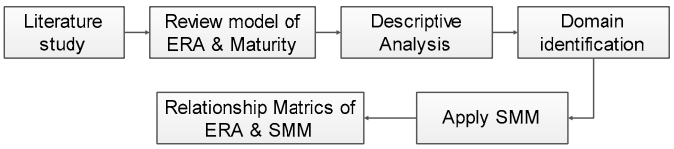

Fig. 1. Research Method

IV. DISCUSSION

A. The Composition of Framework

Component-based framework provides significant flexibility in developing concrete assessment instruments from the existing components and customizes these components as required in relation to the real information needs. The scope of readiness assessment is on a national scale, with assessment model is national context at state ministries and institutions level. As a recommendation for developing countries, by taking into account the lack of resources (technology and finance) and low human resource and institutional capacity (rules and organizations). These components are parts of readiness assessment key factors added with legality (law) factor. This is the conclusion of the combined readiness assessments by UNDESA, Waseda University, Accenture, Brown University, and SAR Macao that have been reviewed by [1], [3], and [20].

Such components are then compiled into instruments as a foundation in designing framework model that can be used by various existing government organizations. It consists of management and organizational structure, legal and regulatory development, application of electronic services, technology infrastructure development, human resources education and training. Furthermore, each foundation will be used together in a framework for assessing readiness to support E-gov strategic planning. Such foundation is a key factor in assessing E-gov readiness that is in modular way can be arranged with E-gov readiness assessment framework into Organizational Readiness and Governance and Leadership Readiness, Customer Readiness, Readiness Competence, Technology Readiness and Legal Readiness. Such key factor has added-value than the indexes used by the United Nations and EDGI (E-gov Development Index) which web measurement index, Telecommunications Infrastructure Index and Human Capital Index. And it is nearly equal to index used by ITU (International Telecommunication Union) [10].

An explanation on each key factor used in readiness assessment are as follows:

- Organizational Readiness. Government organizations are usually top-down, to avoid the complicated bureaucracy, it is necessary to set up a special business process that handle E-gov which sometimes has certain specifications.
- Governance and Leadership Readiness. This is a reflection of governance system and the role of leaders in supporting the implementation of E-gov from the planning phase so as to generate good governance.
- Customer readiness. In this case, customer is public, businesses, and other government agencies. As a public administration, government has a mission to serve people, including, individuals who have limitations such as disability due to physical, social, economic, geographic, or cultural factors in order to allow them to access and gain public confidence.
- Competence Readiness. It is support to knowledge and HR skills in various fields within the framework of implementation, maintenance, and development.
- Technology Readiness. Availability of ICT Infrastructure such as hardware, software, network communications, Internet penetration, and software applications.
- Legal Readiness. Arrangement on the use of E-gov needs to be formally regulated to provide legal certainty in a government. Therein, there are the need for legality in conducting electronic business transactions, electronic document exchange, data sharing applications crossing organizational boundaries, duties and obligations in Internet transactions, electronic payment, fingerprint identification verification, electronic signature and authentication procedures.

B. Composition of Assessment Components

After arranging readiness assessment instruments, components covering each of the said instruments need to be developed. The global arrangement of components has been done by [8]. Such global arrangement of components cannot be used appropriately in the application of E-gov at national level in a country. This is because the components are still divided in 8 contexts. Those contexts are C1 (International Context), C2 (National Context), C3 (Enabling Environment), C4 (E-gov Demand), C5 (E-gov Capability), C6 (Stakeholders), C7 (Technology) and C8 (Perceptions and Challenges) [8]. Table I shows the components that are arranged according to context level and the information source.

TABLE I. COMPONENTS OF NATIONAL CONTEXT READINESS ASSESSMENT

Context Name	Component
C2 (National Context)	1. Political Development 2. Geographic, Demographic, and Cultural needs 3. Socio-Economic Trends 4. Environmental Factors
C3 (Context of Enabling environment)	1. Strategic policy and aims 2. Public Sector Reform 3. Regulation, Legislation 4. Leadership and coordination 5. Funding Infrastructure 6. Partnership
C4 (E-gov Demand)	1. Public Service 2. The Use of ICT 3. ICT literacy 4. ICT Education
C5 (E-gov capability)	1. Front-Office system 2. Back-Office System 3. Database 4. Data Sharing 5. Data Interchange 6. Electronic Document 7. Resource 8. Running Project Initiatives
C6 (Stakeholder)	1. Government 2. Society / Citizens 3. Private sector 4. NGO 5. Academicians 6. Bank 7. International Organizations 8. Experts
C7 (Technology)	1. ICT Infrastructure 2. Access to Information and e-service 3. ICT Application
C8 (Perception and Challenge)	1. Perception with respect to e-gov 2. Challenges

In the context above, from C1 to C8, the application of national readiness assessment used is C2 to C8. C1 is not used because the context is international. C2 and C3 information source is obtained on a national scale. So are C4, C5, C6, C7, C8. Each component in each context obtains information from a source which mainly comes from the Policy Document (PD), Report (R), publications (P), and portal and website (P/W).

Table II shows the component allocation which is more than one to the key factors. Challenge component exist on organizational, governance and leadership, competencies and legal readiness. So do front office and back office system. It is tailored to the needs that exist in each component that must be met at the readiness key factors. For example, challenge component will always exist along with the development of technology and information services. Thus, in order to meet the people's demand on information services, it requires human resources competence, governance and leadership, organization, and the need for legal certainty on the legality for the data use and information security.

TABLE II. COMPOSITION OF COMPONENTS WITH READINESS ASSESSMENT KEY FACTORS

Key Factors/ Readiness	Component being Assessed
Organizational Readiness (OR)	1. Socio-Economic Trends 2. Environmental Factors 3. Public Sector Reform 4. Funding Infrastructure 5. Partnership 6. Public Service 7. Challenges
Governance and Leadership Readiness (GLR).	1. Leadership and coordination 2. Perception with respect to e-gov 3. Front-Office system 4. Back-Office System 5. Challenges
Customer / Stakeholder Readiness (CR)	1. Government 2. Society / Citizens 3. Private sector 4. NGO 5. Academicians 6. Bank 7. International Organizations 8. Experts
Stakeholder / Human Readiness (HR)	1. The Use of ICT 2. ICT literacy 3. ICT Education 4. Resource 5. Running Project Initiatives 6. Challenges
Technology Readiness (TR)	1. ICT Infrastructure 2. Access to Information and e-service 3. ICT Application 4. Front-Office system 5. Back-Office System 6. Database 7. Data Sharing 8. Data Interchange 9. Electronic Document
Legal Readiness (LR)	1. Political Development 2. Regulation, Legislation 3. Geographic, Demographic, and Cultural needs 4. Strategic policy and aims 5. Challenges

C. Maturity Phases and Assessment Tool

Each implementation of E-gov can be assessed in order to identify the extent of E-gov development and progress. E-gov maturity phase or level used is the one reviewed by [12] consisting of *presence*, *interaction*, *transaction*, and *integration*. From the four phases, the limitation of each maturity phase shall be defined. Therefore, it will be able to give a clear figure on the relationship between E-gov readiness and E-gov maturity phase. Thus, the readiness assessment to the maturity level can be easily determined

This E-gov maturity phase is a part of E-gov development evolution which is generally carried out by the United Nations. E-gov development evolution includes phase of presence, enhance presence, interactive presence, transactional presence, and network presence (Table III). Hence, the development of E-gov from readiness to maturity levels leads to such evolution.

The explanation on maturity phase which includes the limitation of each phase is as follows:

1. Phase 1: Presence. The existence of E-gov portal is just simply exist with one-direction information from of government to citizens. Society can only view and download information.
2. Phase 2: Interaction some features are added such as forms that can be downloaded, interaction with email, links to

relevant sites, providing testimonials, information may be in the form of audio and video, and search facilities.

3. Phase 3: Transaction. Community and government can interact actively including making online transactions such as paying taxes, fines or renewing driving licenses and certificates.
4. Phase 4: Integration. Government can serve public with full online service. Either among government agencies, with private sector, and communities. Or communities and businesses entities, and community with community. Both vertical and horizontal relationships, including public participation in e-democracy.

TABLE III. E-GOV MATURITY PHASE WITH ASSESSMENT ASPECTS

Phase Aspect	Phase 1 Presence	Phase 2 Interaction	Phase 3 Transaction	Phase 4 Integration
1. Organizational Readiness (OR)	Not available or just formality, Requires awareness	Available but the structure is still limited, need trust	Available and defined formally, through vision and mission, Able to Make Choice	Available, structured and having completed stages, vision and mission able to provide Consultation and Control
2. Governance and Leadership Readiness (GLR)	Simply limited to implementation with Limited knowledge resources, The existence of Information / Data Collection	There is Technical Instruction and Stakeholder management capabilities, The Use of Important information	There is Technical Guidance and Formal Implementation Guidance as well as Dimensional knowledge. Information Sharing and Data Protection are required	There are agreements and understandings with other parties Qualified Knowledge Characteristics and Creation, Knowledge Characteristics and Creation
3. Customer/ Stakeholder Readiness (CR)	Just simply receiving information, needs to be made aware of the importance of public information	Know and aware of the importance of information	Understanding the transactional rules and making it as real need	Being part of the national life so that it needs to be able to recognize the various types of information with the various rules and coherence, as well as having devices for connection
4. Competence /Human Readiness (HR)	Experienced operators or technicians	Human Resources are suitable with knowledge with limited experience	Human Resources are suitable with knowledge, having experience in their field with the addition of appropriate short-course competence	Human Resources are suitable with knowledge, experienced, and having national / International-reputation certification for each competency required
5. Technology Readiness (TR)	Simply connected to LAN, intranet or internet with not guaranteed connection reliability. Basic Web, bulletin board	Network infrastructure is largely achieved with an adequate connection. E-mail, Download, Search Engine, Electronic data interchange	Having NOC and supporting infrastructure with reliable capacity, connectivity and security. E-filling systems, Interoperability technology,	Complete, certified / licensed / standard infrastructure and technology and international reputation for integrated operability and connectivity, up to date applications and interfaces, Public Key Infrastructures (PKI)
6. Legal Readiness (LR)	Unclear or simply in the form of commands or instructions	Organization Internal Rules	Good national rules, clear and protected system implementation and stakeholder rules	Formal national rules is integrated with international rules, protection for stakeholders is reliable.

Maturity assessment tools are determined based on the domain or aspect to be assessed. In this paper the domain or the aspects to be assessed are determined based on the readiness key factors which includes six (6) aspects namely organization, governance and leadership, customer, competence, Technology Infrastructure, and Legal. Indicators of each maturity phase to aspects are shown in Table III. Table III shows the relationship between each E-gov maturity phase with the covering aspects as E-gov readiness assessment indicators. Then, these indicators are matched with the assessment components becoming the readiness assessment key factors listed in Table II. For example, in the assessment component with the key factors or Technology readiness, it can be assessed as the following table.

TABLE IV. EXAMPLE OF TECHNOLOGY READINESS ASSESSMENT

Component being Assessed	E-gov Maturity Phase Met	Remarks
1. ICT Infrastructures	2	Each components are summed (TR) = 2+2+3+3+2+2+2+1+1 Total (TR) = 18 Average (TR)= 18 / 9 Then, Average TR = 2 Thus, E-gov Maturity Phase is phase 2 for Technology Readiness (TR) aspects
2. Access to Information and e-service	2	
3. ICT Application	3	
4. Front-Office system	3	
5. Back-Office System	2	
6. Database	2	
7. Data Sharing	2	
8. Data Interchange	1	
9. Electronic Document	1	

In the example as shown in Table 4 above, all aspects becoming the assessment key factors apply. Each aspect is calculated similar to example 4 and subsequently is calculated by summing all new aspects and then divided by six (6) which is the sum of the readiness aspects. The assumption used is the percentage of each component that is considered equal. After each aspect is assessed, then the value of each of these aspects is summed. The sum is divided by the total number of assessment aspects. Thus, the formulation becomes (1).

$$EgMP = \frac{\sum_{i=1}^{N} AAi}{N}, with\ AA = \frac{\sum_{i}^{n} CAi}{n} \quad (1)$$

Where EgMP is the E-gov maturity phase, CA is the components assessed, AA is the assessment aspects, n for the components total per-AA, AC is the assessment components, and N is the assessments aspects total.

In Table IV there are 3 columns showing column of components being assessed (CA), column of Maturity phase Met (EgMP), and column of Remarks. Column of Components being assessed is column that contains all components being assessed on any or each aspects. Column of E-gov maturity phases met is the value of each component in each aspect by giving a value of 1 to 4 (in accordance with E-gov maturity phase). Column of Remark contains the resulted calculation. The resulted value of EgMP shall be in round number. If the average resulted value of EgMP is in fraction, it shall be rounded to know the position of E-gov maturity phase. The rounding of EgMP value shall follow the general rules of number rounding. If the fractions value is less than a half (0.5), then it shall be rounded down, and if the fractions value is a half (0.5) or more, then it shall be rounded up.

By using (1), the value of each E-gov maturity phase can be generated for each assessment aspect (AA). Thus, the strengths and weaknesses focus on every readiness aspect can be identified. In further, correction and improvement can be carried out to aspects with low value. In addition, the overall value of E-gov Maturity Phase (EgMP) can also be seen. This is to know the position E-gov maturity phase at this time, and in further, then correction and improvement can be carried out to improve the value of E-gov maturity phase.

V. CONCLUSION

This paper reviews recent E-gov assessment model as well as existed 25 maturity models. From the results of review conducted by previous researchers, in this paper, aspects and components being assessed from E-gov readiness are determined. Furthermore, form those assessment aspects, the guidelines or limitations that must be met at each E-gov maturity phase are determined.

The result a calculation formula of E-gov readiness to justify E-gov maturity phase. Therefore, by knowing the position of E-gov maturity level, the decision makers of national E-gov organization can immediately take measures and actions necessary to evaluate the components on every assessment aspect of that are considered weak. Furthermore, making corrections on the weak components may improve the future of E-gov maturity level or phase.

Further research needs to be conducted, especially to provide more complete and detailed explanation on the relationship between E-gov readiness aspects and E-gov maturity phase. It is also necessary to consider the weight of assessed components being assessed. This may provide convenience and valuable detail each component readiness to E-gov maturity phase.

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