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# Assessing the E-Government Maturity for Public Sector Innovation in Developing Countries: Case of National Informatization Assessment Tool (NIAT)

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**Abstract.** This paper presents a new approach to assess the e-Government maturity with an aim to facilitate public sector innovation in developing countries. NIAT takes a rare approach to comprehensively assess the needs and capabilities by a participatory measure. It provides a standardized assessment process in order to ensure the quality of data. NIAT contributes to the service innovation by providing improved contents for e-Government services and identifying priorities of ICT strategy. It also stimulates organizational innovation in the public sector by building capacity of stakeholders across governmental silos and sectors. NIAT is a toolkit for quick deployment of ICT strategy and action plan grounded on actual experiences of e-Government developments in Korea. By offering a proven, pre-costed pool of projects readily applicable in practice, NIAT allows an accelerated prioritization of the relevant projects. In addition, the participatory process involving key actors in the government is a consensus building mechanism to generate political buy-ins for the project chosen.

**Keywords:** e-Government, developing countries, public service innovation, e-Government maturity, National Informatization Assessment Tool

## 1 Introduction

Over the last decade, there has been a plethora of initiatives of e-Government implementation in developing countries [1]. Reflecting the movement, e-Government has been one of the most frequently researched topics in the field of studies that examine the role of information and communication technologies for socioeconomic development (ICT4D) [2,3,4,5,6]. In particular, with the launch of the Sustainable Development Goals (SDGs) as a new agenda for international development cooperation, e-Governance in developing countries receives a renewed attention as an instrument of public service innovation [7,8,9]. In general, innovation in the public sector refers to “significant improvements to public administration and/or services” [10]. E-Government is more than “government-as-usual” on top of the existence of ICT [11]. Once necessary infrastructure is in place, e-Government increases the efficiency of public service by saving time and cost required for the delivery, as well as broadening the outreach, of service. Further, improved visibility and transparency of the public services put pressure for increased accountability on the government agencies, thereby help building citizen trust in the government. Particularly in developing countries, e-Government is expected to contribute to inclusive development by allowing equitable access to key public services for all citizens, while strengthening the institutional capacities of the government by providing opportunities for civil servants to learn about, and adopt, the standardized best practices.

With this shift of focus, the method to decide the priorities of development areas in e-Government, particularly in the context of resource-poor developing countries, also faces a call for change. There are a number of existing methodologies to assess the priorities of e-Government development [12,13,14]. While details may differ, they tend to emphasize in common the delivery aspect of e-Government. Considering that one of the most pressing challenges in e-Government implementation in developing countries arises from the inadequate level of ICT infrastructure, the accessibility to online public service occupies one of the top concerns in the decision-making related to e-Government. However, when applied from the perspective of public sector innovation, the decision of the priority areas in e-Government should also be made with a renewed set of criteria. As Windrum and Koch [15] note, public sector innovation encompasses improvements in a variety of areas, not only including the methods of delivery, but also the contents of the service as well as the institutional and organizational structures in which decisions are made. In this sense, a new approach to assess the levels of development and the priorities of e-Government is needed that considers beyond the expansion of delivery channels of existing public services.

With this background, this paper proposes a new method titled National Informatization Assessment Tool (NIAT) to assess the priorities of e-Government development for developing countries particularly under the context of international development cooperation projects. Based on e-Government development from the perspective of public service innovation, NIAT offers: 1) a set of proven, readily available options extracted from previous surveys to improve the contents and delivery of online-based public services, reflecting the supply side capabilities of the e-Government develop-

ment, and; 2) opportunities for organizational innovation within the government agencies based on a participatory assessment process.

This paper is organized as follows. In the next section, we explore the literature and the context of e-Government development in developing countries, and review existing tools for the assessment of e-Government priorities in developing countries. In section 3, we explain the background of the NIAT development. In the following sections 4 and 5, we discuss the NIAT model in detail in terms of its theoretical backgrounds and implementation stages. Finally, in section 6, we discuss the contribution of NIAT in public sector innovation in developing countries and conclude with prospects for future works.

## **2 Review of Literature and Context**

### **2.1 E-Government Development in Developing Countries**

Much research exists that explores the challenges of e-Government implementation in developing countries. A stream of research explores the factors influencing the high failure rates of e-Government in developing countries [2,3], [5]. The digital divide, both in terms of the technical infrastructure as well as the institutional and human capabilities to utilize ICT, poses a significant challenge to the widespread adoption of e-Government in developing countries. The income level of a country is a general indicator of economic capacity and progress, which thus influences its e-Government development particularly concerning the availability of technical infrastructure [16]. However, another stream of research suggests the importance of social and organizational changes for e-Government to be fully functional [17]. It requires much more than the technical capabilities to successfully implement and operate online public services; constraints are typically a combination of political, legal, financial, organizational, institutional and human capital factors [18, p. 4] [19].

Among these difficulties, one of the major challenges in the e-Government development is the problem of fragmentation. Fragmentation in ICT systems usually refers to a lack of coherency in the different applications composing a larger system. Fragmentation is more likely to happen and difficult to remedy in e-Government which is usually composed of systems in different subject areas under the supervision of different government agencies and departments. The sources of such fragmentation may vary. Sometimes the weak institutional capabilities result into unclear objectives and inadequately designed systems. Insufficient planning may cause cost overruns and even unfinished projects, which inevitably interrupt the continuity and coherency of e-Government initiatives. The same result can be caused by a simple lack of, or unpredictability of, funding arrangements from the government or donors. In addition, there is a general shortage of specialized human resources in developing countries, which leads to reliance on support from external expertise.

In sum, despite the already significant level of exposure to e-Government initiatives in developing countries, there is a high prevalence of failures which makes the governments in developing countries start to realize that ICT projects are not neces-

sarily a silver bullet. A greater amount of political capital is needed in order for a project to go through. Additionally, although government officers have a general idea of what they want for ICT innovation, in many cases they lack the technical expertise to design and implement the e-Government projects. Combined together, they result in the problem of a fragmented and incoherent approach to national ICT development.

## **2.2 Assessment of E-Government Development**

One method to alleviate this problem of fragmentation is to enhance the policy coherency of e-Government initiatives through the establishment of tailored national e-Government development plan. There are certain advantages a country can attain by establishing a sound blueprint. For example, it allows developing a long-term strategy, possibly linked with the national ICT master plan. Vertical and horizontal coordination within the national ICT master plan and across other key development areas is also possible. It also allows reflecting the priority areas of e-Government into the national plan much easier. Last but not least, a blueprint with specific goals helps establishing benchmark goals for evaluation, as well as facilitating resource mobilization.

There are several existing methodologies and global indicators that seek to measure the maturity level of a country's e-Government development and recommend areas of priority to establish a national blueprint that reflects the current status.

First, the United Nations e-Government survey is a well-known assessment tool [16]. The survey provides a systematic approach to measure the degree of e-Government development in three dimensions including telecommunication infrastructure, human capital, and online services and contents. While it offers a globally comparable snapshot of e-Government development of a country, the index in its nature is simply a policy research report. As such, its utility as a tool for development planning is limited. Therefore, it is not easy to readily apply the findings of the e-Government survey into actual project development and implementation in developing countries.

Second, ITU's e-Government Implementation Toolkit [13] takes a consulting-oriented approach and provides priority areas of action based on the level of ICT readiness and national development strategies in the country. Specifically targeted for decision-makers in developing countries, it aims to provide a hands-on tool for national initiatives for e-Government development. However, the degree of customization available in the toolkit is not sufficient to fully reflect the political and organizational concerns and priorities that are not necessarily captured in statistics on national income and ICT usage. And it currently lacks a detailed guideline on how to utilize this tool, from the assessment leading to the establishment of a customized e-Government development plan.

Apart from these two international initiatives, there are other public, private, and research-led approaches on e-Government assessment. Even though they offer unique strengths that make them worth referencing, they share similar limitations such as limited data availability outside the authoring organization, insufficient room for na-

tional contribution and customization, and lack of linkages to actual projects for easier implementation.

With this background, we propose a new methodology to respond to the following three objectives: 1) assessing the degree of e-Government development in a country, 2) providing a policy-oriented approach for easier establishment and implementation of a national e-Government development plan, and 3) providing a participatory approach for enhanced ownership and coherence.

### **3 Research Background**

#### **3.1 Background of NIAT Development**

The National Informatization Assessment Tool aims to provide a quick solution to examine the current status of informatization including the level of e-Government maturity, and recommend priorities of initiatives and actions for e-Government projects through a consensus-based approach for easier application in the field. NIAT is a product of decades-long ICT and e-Government consultations carried out by the National Information Society Agency of Korea (NIA), a key wing for ICT4D in the Korean government's ODA (official development assistance). NIA is a statutory agency affiliated with the Ministry of Science, ICT and Future Planning and responsible for the overall implementation of and support for national informatization [20]. NIAT has been developed amid the increasing requests from developing countries to provide consultations on national ICT and e-Government strategy and action plan. These consultations naturally led to the use of templates and checklists to ensure the quality of the output. The quality of the consultations has been further developed through process standardization with support from specialists in diverse areas to streamline and improve the overall consultation processes.

#### **3.2 Development History of NIAT**

The development of NIAT entailed three simultaneous activities: accumulation of knowledge and know-hows by consultants, process standardization led by experts from both academic and practice, and streamlining of the process for the development of a software tool.

First, for the accumulation activities, data was collected by internal and external consultants who directly participated in the consultation for e-Government mater plan development in four countries, including Bulgaria, Columbia, Ecuador, and Uganda. The consultation was conducted under a public-private-academic partnership: NIA as a government agency, an information systems (IS) company, and university-based researchers. Consultation encompassed the areas of inter-governmental cooperation framework, policy consultations with high level officials and workshops, strategy planning including action plans and budgetary allocation, and feasibility studies for specific areas of application. These experiences were shared and accumulated in internal meetings and documents. Even though this knowledge existed in an unstructured form, piecemeal, incremental process revisions were made.

Second, the process standardization was carried out in two phases in 2014 and 2015. Reviews of existing research on e-Government maturity assessment were conducted to fine-tune the NIAT process. Based on the result of literature review, expert interviews and accumulated knowledge from previous applications, seven stages of the NIAT standard procedure were defined (see 5.2). Particularly for the stages 3 and 5 where weighted calculations are required to draw out stage outputs, a modified analytical hierarchical process (AHP) was applied to decide appropriate weights. AHP is a widely used method to derive priority scales based on pairwise comparisons conducted by experts [21]. A team of external experts from both academic and industry participated in the standardization process including the AHP.

Lastly for the streamlining, inputs were collected from the workshops among consultants in the field, as well as interviews from the national stakeholders who participated in the NIAT consultation process in their countries. The updated NIAT was then developed into a web-based tool.

#### **4 Theoretical Framework of NIAT**

NIAT is composed of three dimensions: 1) Macro analyses, 2) Improvement Themes, and 3) Maturity Evaluation. Combined together, they provide a comprehensive view over what development opportunities lie ahead in e-Government in the country under study.

First, the macro analyses are further divided into two parts: Country Positioning and PESTLE Analysis. Country Positioning draws on the country classification conducted by the ITU toolkit [13], and provides a general idea of project priorities according to the country's income level. The PESTLE (Political, Economic, Social, Technological, Legal, and Environmental) Analysis is an expansion of the original PEST analysis suggested by Aguilar [22], which assumes that external industry conditions have causal relationship with implications and consequences for the organization. These external conditions are also causally related with the areas of management attention in strategic management. The NIAT PESTLE analysis also looks at the country's informatization ecosystem to derive implications for priority areas of development. In particular, the following six questions are asked. What is the political situation of the country and how does it affect national informatization? What are the prevalent economic factors influencing national informatization? What are the prevalent social factors influencing national informatization? What technological trends and innovations are expected to affect national informatization? Are there any current legislations, or changes in the legislations that are relevant to national informatization? What are the current environmental concerns?

Second, the Improvement Themes refer to pre-defined strategic areas in which the country's national ICT development plan can focus on. They are categorized into four groups: Government, Citizen & Society, Business, and ICT Infrastructure. The four groups are made of a total of 17 Improvement Themes, and 17 Improvement Themes are further broken down into 64 maturity indicators. For each group, relevant Improvement Themes and maturity indicators have been identified by defining service

needs that arise as national informatization progresses and by referring to Korea's benchmark cases.

Third, NIAT assesses the degree of national e-Government development using a 5-level maturity model, which is adapted from the UN e-Government Survey [12]. The model covers four areas including the processes, systems, services, and organization of e-Government, and classifies them into 5 levels. Level 1, Initial level, refers to a situation where e-Government process has not been stabilized yet. In Level 2, Developing level, a basic e-Government process as well as a computerized database (DB) is established for each unit of action. In terms of the organization and service, general guidelines and services are available but with limited information. Level 3 indicates a Defined level, where the processes are established for each entity composed multiple units. Systems and DB are also connected intra-entity level. From the service aspect, users may find information on the web, and download key information and forms. In Level 4, Managed level, processes are established across different entities, and the systems are connected at the inter-entity level. In terms of the services, online processing of administrative services is available. In Level 5, Integrated level, the processes and systems are integrated into a generalized process and a common operation system. e-Resources are also managed through a generalized management system. Users enjoy seamless one-stop service offerings across departments and entities.

## **5 Application of NIAT**

### **5.1 A Participatory Workshop**

In many ICT projects in developing countries, employees and managers of the institution concerned do not have the technical education, training, and means to develop a solution that will sustain the transformation process [1]. They usually do not participate in the development processes and such a lack of participation has been identified as a challenge to public sector innovation in developing countries.

NIAT primarily draws meaning from the insights of the national stakeholders, since they have the best understanding of what needs to be done. This in mind, NIAT is designed to be conducted in a one-day workshop; national stakeholders can participate in a simplified consulting process structured in 7 stages of standardized activities. It is important to involve a diverse group of stakeholders in the participatory workshop, including: government officers both executive and working levels, ICT and e-Government domain experts from national organizations, private sector, academia, and citizens represented by the NGOs and civic groups. Previous NIAT workshop experiences show that an appropriate size of the group ranges from 20 to 50 persons in one setting.

Such a workshop gives the stakeholders a general idea of what types of national e-Government projects should be implemented. By introducing Korea's e-Government and national informatization benchmark cases alongside the identification of priorities, quick win projects can be rapidly identified. In addition, the workshop focuses on reaching a consensus of stakeholders on the results of each of the stages, thereby enhancing their ownership over the project and offering a shared learning opportunity.



## 5.2 NIAT Process: A 7-stage Model

This section explains the 7 stages of NIAT application. The first stage of NIAT, Country Positioning, begins with identifying the country's economic position according to its income level in terms of gross domestic product (GDP) per capita in USD. Based on the country's income level, different weights are automatically given to each Improvement Theme. In order to assign weight, NIAT draws on from the ITU e-Government Implementation Toolkit [13]. The ITU undertook a statistical analysis of countries with different income levels and found out that there is a statistical correlation between income levels and different priorities of projects. Following the ITU approach, countries are classified into four groups including: low-income, lower-middle-income, upper-middle-income, and high-income economies. For each income group, different weights are given to each Improvement Theme, reflecting the relevance and impact of the specific Theme under the income group.

Stage 2 is the PESTLE Analysis stage for analyzing the country's macro-environment in six areas including political, economic, social, technical, legal and environmental, in order to further prioritize the Improvement Themes. Various factors have been identified for each of the six areas, which are divided into a total of 64 PESTLE indicators. The actual analysis is carried out by rating the current status of 64 PESTLE indicators of the country using a five-point scale. In-depth interviews with key stakeholders in the country are necessary to adequately capture different factors that may affect the informatization level of a country. Combined with the result of the Country Positioning, the output from this exercise provides additional weighting values for calculating the final prioritization list.

Stage 3 is Selection of Improvement Themes where priority Improvement Themes are selected, which indicate the areas of the most pressing needs. The selection is automatically generated based on the input from the second stage, combined with a pre-defined, weighted mapping logic embedded in NIAT. As mentioned earlier, a group of experts conducted a modified AHP to map the PESTLE factors to the improvement themes. The panel of experts in AHP conducted the mapping process based on the two main criteria of relevance and impact.

Stage 4 is dedicated to reviewing the automatically selected list of Improvement Themes in the previous stage, reflecting any specific conditions or needs identified through the deliberation process among participating stakeholders. In particular, the selected Improvement Themes should be reviewed in comparison with the results of income-group categorization from Stage 1, reflecting the intuition and experiences of the stakeholders and the consultants.

Stage 5 is Maturity Evaluation. Maturity Evaluation is conducted for the 17 Improvement Themes. For each Improvement Theme, two to four maturity indicators are defined to measure different dimensions of achievement, adding up to a total of 48 indicators for all the 17 Improvement Themes. For each maturity indicator, the participating stakeholders evaluate three aspects: Current situation (As-Is), Future demand (To-Be), and Ease of implementation. To facilitate the evaluation process, a five-level maturity model has been adopted from the UN e-Government Development Survey

[16]. The results of the maturity evaluation are used as additional weighting values to calculate a prioritized list of informatization projects in Stage 6.

Stage 6 is Prioritization where a list of priority maturity indicators is automatically identified based on the results of the previous stages. Three criteria, defined by the expert panel and tested in Korean informatization cases, are used to decide the priority of maturity indicators, including the impact, urgency and ease of implementation. Maturity indicators that have the highest values from each of the three criteria are selected as priorities, which should be the first concern when implementing a national e-Government development plan.

Stage 7, Recommendation, displays the final result of NIAT, that is, a list of recommend projects aligned with the prioritized maturity indicators from Stage 6. A repository of e-Government projects has been created from Korean ICT development history and other global good practices, which provides an access to readily available projects for implementation. The result can be used as a basis for a general roadmap of the national e-Government development plan. However, additional modifications may be needed depending on prerequisites that are different for each country.

## **6 Discussion and Conclusion**

### **6.1 Improving the Contents of E-Government**

While the focus of e-Government literature in general is expanding to cover a citizen-centric perspective on e-Government under the theme of e-Participation [23], the difficulties of capturing the demand side reality in developing countries still make it a challenge to produce meaningful findings for both academic and policy-oriented research. In fact, those attempts to measure the demand of e-Government in developing countries constitute necessary and legitimate efforts to respond to the societal requirement. However, given the situation of developing countries where information gathering from the citizen is constrained due to the lack of technical capabilities and paucity of resources, their merits in practice still remain a question. Incomplete and incorrect information on e-Government demand may mislead or sometimes even distort the allocation of already scarce resources in developing countries, defeating the goals of achieving efficient and innovative public service delivery. In this sense, particularly for the purpose of policy consultation in developing countries, a shift of focus towards the supply side requirements may yield more practical and useful results.

NIAT focuses on adequately addressing the supply side requirements on three fronts, first by comprehensively collecting the policy needs through a series of participatory analyses, second by providing a pool of proven, readily available policy options from the Korean and global good practices, and third by matching the policy options to meet the specific needs of the country through a refined approach. That said, NIAT assists to enrich the contents of public service innovation through e-Government, as it provides a set of proven, ready-to-implement e-Government projects based on the strategic needs of the country.

## **6.2 Enhancing Participatory Innovation through E-Government**

As Eggers and Singh [24] argue, the particular problem with innovation in public sector is not so much about the absence of innovation per se, but the ad hoc nature of the innovation which often fails to develop the very own capacity of the public sector to continuously innovate. Particularly in developing countries where e-Government implementation in many cases is associated with a large-scale donor support, it is the external experts from the outside of the country who usually drive the initiative. Given the circumstances, e-Government development tends to focus on giving the fish rather than teaching how to fish. The lack of involvement of national stakeholders in the process of e-Government development, in this sense, significantly impedes the potential of locally-driven, sustainable public sector innovation in developing countries.

NIAT, by offering a standardized procedure to conduct a participatory decision-making in the national e-Government development, contributes to growing this key capability of national stakeholders. Apart from the existing approaches where the focus of attention lies in the application of technological inventions in the public sector, NIAT emphasizes the important contributions of the social and political actors either in the e-Government and/or national ICT strategy development processes. In particular, NIAT invites a variety of stakeholders in a participatory workshop to make important development decisions in e-Government. This workshop provides a platform for collaborative interaction and learning among different stakeholders. In the workshop, stakeholders may share the objectives of the innovation, build a consensus on the areas and methods to respond to a call for innovation, and check whether the relevant stakeholders possess the necessary skills to make the innovation work [25]. Such a shared understanding of goals and methods of e-Government among stakeholders may reduce the problem of fragmentation, by facilitating collaboration across different departments in the government and different sectors of expertise. In addition, NIAT emphasizes the input from the government officials when prioritizing the areas of development. Such a focus enhances the ownership of the government officials as a key actor of the project, coordinating the innovation network and sometimes brokering an emergence of a new one as an entrepreneur in the public sector [15].

## **6.3 Ensuring the Quality of Innovation in a Standardized Process**

NIAT offers a standardized process of e-Government assessment to enhance the quality of public service innovation in developing countries. As mentioned earlier, NIAT offers a set of structured activities in each stage to prioritize the areas of e-Government development. In particular, this process of standardization takes up an important part of the NIAT development. Generally speaking, a typical consultation process requires substantive efforts in preparation. It entails a variety of quantitative and qualitative measurements of the governance structure, policies, and economy as a prerequisite. Therefore, ensuring a consistent quality of the outcome remains a challenge. Sometimes the analyses may derive different outcomes depending on the institutional factors such as the degree of political will, availability of data, and human

factors such as the capacity of the consultants and the quality and scope of participating stakeholders in the country. In this regard, the development of a standardized assessment method and a software tool for additional support, despite the significant amount of initial works required, offers advantages. For one thing, NIAT ensures the quality of the consulting outcome based on refined, proven experiences. In addition, by defining a set of common, objective standards, it helps reduce the cost of coordination and prevent redundancy of work.

#### **6.4 Limitations and Future Work**

In this paper, we presented a novel approach to assess the e-Government maturity with a particular aim to help facilitate public sector innovation in developing countries. From the research aspect, NIAT takes a rare approach to comprehensively assess the supply side needs and capabilities from a participatory measure. It also provides a standardized assessment process in order to ensure the quality of data for a more accurate and customized outcome. NIAT not only contributes to the service innovation by providing new contents for e-Government services, but also stimulates organizational innovation in the public sector by offering a learning opportunity among stakeholders across governmental silos and sectors. In the practice side, NIAT is a time-saving method for practical application grounded on actual experiences of e-Government development and national informatization in Korea. By offering a proven, pre-costed pool of projects readily applicable in practice, NIAT allows an accelerated prioritization of the relevant projects. In addition, the participatory process involving key actors in the government is a consensus building mechanism to generate political buy-ins for the project. Despite these contributions of NIAT, there are certain limitations. For one thing, more empirical data should be collected from actual consultations of e-Government development in developing countries, in order to verify the efficacy of NIAT as a policy-oriented tool for e-Government assessment. Additionally, even though the lack of attention to the demand side requirements in NIAT is intentional in the design, further efforts are needed to identify the needs of citizens in developing countries and assess their levels of engagement in e-Participation. Considering the particular context of e-Government in developing countries as a solution to improve the delivery and contents of public services to the disadvantaged, e-Participation should be approached not only to assess their degree of access but also the needs to improve their livelihoods.

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