Conception, Development and Implementation of an E-Government Maturity Model in Public Agencies

Gonzalo Valdés, Mauricio Solar, Hernán Astudillo, Marcelo Iribarren, Gastón Concha, Marcello Visconti

Departamento de Informática
Universidad Técnica Federico Santa María, Valparaíso, Chile.

Corresponding author: Gonzalo Valdés, valdes.ulloa@gmail.com

Abstract
Governments worldwide are encouraging public agencies to join e-Government initiatives in order to provide better services to their citizens and businesses; hence, methods of evaluating the readiness of individual public agencies to execute specific e-Government programs and directives are a key ingredient in the successful expansion of e-Government. To satisfy this need, a model called the eGovernment Maturity Model (eGov-MM) was developed, integrating the assessment of technological, organizational, operational, and human capital capabilities, under a multi-dimensional, holistic, and evolutionary approach. The model is strongly supported by international best practices, and provides tuning mechanisms to enable its alignment with nation-wide directives on e-Government. This article describes how the model was conceived, designed, developed, field tested by expert public officials from several government agencies, and finally applied to a selection of 30 public agencies in Chile, generating the first formal measurements, assessments, and rankings of their readiness for e-Government. The implementation of the model also provided several recommendations to policymakers at the national and agency levels.

Keywords: e-Government readiness, maturity model, IT governance.

1. Introduction
In addition to the necessary technological initiatives, the implementation of e-Government programs in a country is accompanied by the redesign of processes that support the new models of service delivery, by structural reforms in the public agencies that establish those responsible for promoting and managing new technologies, and by major efforts to update the legal framework to support and regulate the use of information and communication technologies (ICT) in the public sector. For example, in Chile, several regulations have been issued in this regard,1 and an interoperability platform (funded by the Inter-American Development Bank)2 is currently being built to enable public agencies to exchange and integrate information coming from different services.

Hence, there is a need to measure and assess the readiness of public agencies to comply with new national directives on e-Government and – more generally – to address the new challenges posed by the e-Government approach to public administration. The eGovernment Maturity Model (eGov-MM) (Iribarren et al., 2008; Solar, Astudillo, Valdes, Iribarren, & Concha, 2009) was a result of a project carried out to satisfy this need; the project was

1 http://www.guiaweb.gob.cl/recursos/documentos.htm
The eGov-MM model allows public agencies to be evaluated against international best practices in the area of e-Government, including the formulation of organizational strategies and policies, management of ICT, operative management, and organizational capabilities of human resources and the organization overall. It also proposes specific roadmaps for capability improvement, i.e., directives about where the financial and human resources of an organization should be allocated to improve its ability to carry out e-Government initiatives.

EGov-MM and its assessment methodology were evaluated, provided with feedback and validated by expert public officials from several government agencies through a pilot study and several workshops, and the model was finally applied to a selection of 30 public agencies, generating the first formal measurements and rankings of their preparedness for e-Government. These results may be useful for the formulation of e-Government policies at national and agency level.

This article is organized as follows: Section 2 defines the theoretical framework to address the problem and presents the state of the art. Section 3 describes the architecture of the eGov-MM model and its mechanisms for fine-tuning with international e-Government trends and the local policy context. Section 4 describes the assessment methodology and the institutional framework needed for effective assessments. Section 5 discusses important issues of the model’s validation and replication of its measurements. Section 6 analyzes the results of the application of the model to 30 public agencies in Chile and provides recommendations for the formulation of new e-Government policies. And Section 7 presents the main conclusions of this work.

2. Theoretical framework and state of the art

The model should fulfill the following four high-level requirements (in relation to e-Government preparedness):

- Enable each public agency to identify its current state of maturity and capability in an integral (considering every necessary aspect) manner.
- Enable each public agency to compare itself with other agencies evaluated with the same model.
- Suggest feasible improvement roadmaps that public agencies can follow to improve their levels of capability and maturity.
- Provide information about the public agencies’ e-Government readiness to allow the government and policymakers to determine whether they are prepared to join the new national e-Government initiatives, and to define improvement programs in case they are not yet prepared.

The following paragraphs discuss the concepts behind the idea of evaluating public agencies with an integral maturity model, i.e., a multi-dimensional, holistic, and evolutionary model, to satisfy the requirements mentioned previously, and they also discuss the use of international evidence as inputs to the model.

2.1. E-Government is a multi-dimensional concept

The great potential that ICTpossesses to support government processes has been recognized worldwide (Yildiz, 2007); e.g., to create interconnectivity networks to improve the efficiency of service delivery, to encourage citizen participation and to increase the transparency of administrative processes. Even though there is no universally accepted definition of the concept of e-Government (Yildiz, 2007), two broad definitions can be cited:
the United Nations’ definition (UN & ASPA, 2002, p. 1): “… utilizing the Internet and the World-Wide-Web for delivering government information and services to citizens” and Fountain's definition (2001, p. 4): “… a government that is organized increasingly in terms of virtual agencies, cross-agency and public-private networks whose structure and capacity depend on the Internet and Web” (Fountain calls this phenomenon “Digital Government” or “Virtual State”). Thus it can be said that e-Government initiatives arise due to a combination of the need to improve the quality and efficiency of public services and the acceptance of ICT as an important element to achieve that goal.

But electronic government is far more than using technology to provide online services (Andersen & Henriksen, 2006; Cresswell, Pardo, & Canestraro, 2006); it often involves the integration of different services provided by public agencies that had never worked together previously, the provision of 24/7 service delivery, the assimilation of new laws and government regulations, and so on (Wimmer & Tambouris, 2002). Therefore, technological change should be accompanied by organizational change (e.g., new institutions for new forms of interaction between public agencies), process redesign (e.g., new processes to operate under new service delivery modes), information technology (IT) governance implementation (to achieve alignment between IT resources and business objectives), and human capital training (e.g., training for staff to operate new technologies). It is also essential to consider how all these aspects interact with each other.

2.2. Capability maturity models

The development of capability maturity models has been a strong trend in various technological and organizational areas. The best-known models are those belonging to the CMM/CMMI family (Capability Maturity Model and CMM Integration) developed by the Software Engineering Institute (SEI); although they were developed for the development, maintenance and acquisition of software products and services, their capability maturity level structure and the mechanisms for determining those levels have been replicated by many other models in other areas.

SEI defines (SEI, 2006a, p. 535), a capability maturity model as one that “… contains the essential elements of effective processes for one or more disciplines and describes an evolutionary improvement path from ad-hoc, immature processes to disciplined, mature processes with improved quality and effectiveness.” Hence, it typically describes best practices related to its scope and supports process improvement by providing evolutionary scales that describe improvement roadmaps.

2.3. Multi-dimensional, holistic and evolutionary maturity model

According to what we discussed in the preceding subsections (2.1 and 2.2), a multi-dimensional and holistic approach allows us to consider the interactions between the necessary elements for e-Government initiatives to be successful (e.g., the relationship between ICT implementation and process redesign); and an evolutionary approach to maturity and capability allows us to describe how these elements should evolve, supporting process improvement. All of which are desirable features for our model.

Additionally, such a model should be accompanied by a methodology that standardizes its application, so that its measurements and assessments are rigorous and replicable; and by an effective institutional framework design (e.g., to define which agency is in charge of the model, how this agency interacts with assessed agencies, etc.). These ideas provide the foundation of the model we developed to satisfy the requirements established at the beginning of this section.

3 http://www.sei.cmu.edu/cmmi
2.4. State of the art

The models studied in this research can be categorized into five groups, which are explained in the following sections (see also Figure 1). Each group includes elements, concepts, and approaches that were considered necessary for the model.

2.4.1. Classic capability maturity models

Classic capability maturity models have been replicated by many other models in several technological and organizational fields, and were analyzed because they represent the typical structure of a capability maturity model. Within this group, CMMI - the USA approach (SEI, 2006a) and ISO/IEC 15504 (Information technology - Process assessment) - the European approach - both stand out. A Latin-American model, called MoProSoft⁴, was also studied (SEM, 2005a); this model is an adaptation of ISO/IEC 15504 to the Mexican setting; it also incorporates elements of ISO 9001:2000⁵ and CMM v1.1 (SW) levels 2 and 3.

2.4.2. Governmental models

Governmental models have been developed by governments, consultants, and academics to help government agencies identify and improve their levels of maturity in relation to e-Government. The following Australian and Canadian examples stand out:

- The Business Process Interoperability Framework (BPIF) (AGIMO, 2007), which contains a maturity model that can be used by agencies to identify their current business-layer interoperability maturity level;
- The Service Delivery Capability Model (AGIMO, 2006), which provides a common framework to identify and describe the capabilities required to deliver service to citizens. When using this model, public agencies describe

⁵ Quality management systems - Requirements, http://www.iso.org
their services in the same way, which thus facilitates better communication and collaboration between them; and

- The eGovernment Capacity Check (Government of Canada, 2000), which is a suite of capacity diagnosis tools that is used to help public agencies assess their capability to deliver electronic services to Canadians.

2.4.3. Holistic approach models for e-government projects

Holistic approach models are designed to be applied in electronic public services development projects. A well-known model in the e-Government academic community is Wimmer’s Holistic Framework (Wimmer & Tambouris, 2002); its purpose is to support the integrated modeling of electronic public services and its synchronization with technological developments (i.e., the implementation of the technical components), so the resulting electronic service from the project meets all the relevant requirements. Another tool using this approach is the Capability Assessment Toolkit (Cresswell et al., 2006), which examines capabilities through 180 indicators identified as important in order to determine whether an e-Government project will be successful. Both models have been successfully applied in Austria (Makolm, 2006) and the U.S. (Cresswell, Pardo, & Hassan, 2007). Other efforts within this trend, focused on assessing the benefits and impacts of e-Government projects and proposals, are the frameworks of Esteves and Joseph (2008) and Montagna (2005); the former is designed to conduct ex-post assessments (after implementation) and the later for ex-ante assessments (before implementation).

2.4.4. Models of e-Government evolution

The evolution of e-Government is often modeled by sequential steps, in the stages of growth models, e.g., the UN & ASPA (2002) identified five progressive stages: (1) Emerging: the government’s online presence is established; (2) Enhanced: government sites increase in number and complexity, and the information becomes more dynamic; (3) Interactive: users can download forms, e-mail officials, and interact through the Web; (4) Transactional: users can pay for services and transactions online; and (5) Networked: full integration of electronic services across public agencies. Other models within this approach include the following: the model of Layne and Lee (2001), which identifies four stages of growth focused on functionality and technical capability; the model of Andersen and Henriksen (2006), which extends the Layne and Lee model by incorporating a customer-centric approach; the model of Gottschalk (2009), which focuses on interoperability; and the model of Klievink and Janssen (2009), which introduces the notion of dynamic capability theory to move up from one stage to the next. Summaries of some of these models can be found in Maumbe, Owei, & Alex (2008) and Shahkooh, Saghafi, & Abdollahi (2008).

2.4.5. Related special purpose models

Related special purpose models are interesting because of their content concerned with ways in which important issues related to e-Government ought to be addressed. Noteworthy examples include COBIT (Control Objectives for Information and related Technology) (IT Governance Institute, 2007), which addresses IT governance; LISI (Levels of Information Systems Interoperability) (U.S. DoD, 1998), which addresses the interoperability of information systems; and EAMM (Enterprise Architecture Maturity Model) (NASCIO, 2003), which addresses enterprise architecture maturity.
3. Model’s architecture

The main elements from the international experiences (described in Section 2 and depicted in Figure 1) that inspired our model were:

- The content, best practices, and approaches contained in the governmental and holistic models, specifically their definition of areas that agencies and e-Government projects should address (e.g., semantic interoperability, enterprise architecture, IT governance) and how these areas are related and grouped together. Also, we supplemented these sources with the study of other models that were not developed for e-Government but that address those areas in greater detail. For example, the governmental models mention IT governance and define it at a high-level; this notion can be further expanded with the study of other models such as COBIT.
- The capability and maturity levels structure and assessment mechanisms from the CMM models, specifically their definition of each level and how the arrangement of these levels conveys roadmaps for improvement.
- The stages of growth described by the models of e-Government evolution, specifically their definitions of what each stage implies and what is needed to move up from one stage to the next.

The study of these models, frameworks, approaches, and experiences was complemented with an analysis of the local reality and policy context of e-Government in Chile, the consultation to local experts and field testing – as we explain in the following sections – to obtain the model we present below.

3.1. General structure

The model is structured around three main elements: Leverage Domains, Key Domain Areas and Critical Variables, which together enable public agencies to consider the necessary aspects to join e-Government initiatives.

The leverage domains consist of key domain areas, which in turn are composed of critical variables, i.e., they are related through a hierarchical structure, as shown in Figure 2. Four domains have been defined (“E-Government Strategy”, “IT Governance”, “Process Management”, and “Organization and People”), 17 key areas (“Vision, Strategy and Policy”, “Enterprise Architecture Strategy”, etc.), and 55 variables (“Strategy Alignment”, “Senior Management Commitment”, etc.). The key areas are also categorized into three management areas, according to the type of management to which they are associated in an organization. These are: Operational Management (framed by rectangles in Figure 2, 6 key areas in total), IT Management (framed by hexagons, 8 key areas) and Human Capital Management (framed by ovals, 3 key areas). The names given to each domain, area, and variable (presented in Figure 2) reflect, at a high-level, the purpose and context of that element, and serve the purpose of presenting the model’s architecture; more details about these elements can be found in (Iribarren et al., 2008).
Fig. 2. Hierarchical structure of leverage domains, key domain areas and critical variables.
3.2. Generic capability model of key domain areas

The leverage domains are logical groupings of key domain areas, the latter are those that must mature further in practice and therefore are subject to evaluation, which is done by measuring their capabilities through their critical variables.

For each key domain area, there is an incremental measurement scale based on a score ranging from 1 to 5; this scale is associated with the following generic qualitative model:

- **Level 1: Initial Capability.** The key domain area is addressed reactively and individually on a case by case basis; and there is evidence that it has been recognized and needs to be addressed.
- **Level 2: Developing Capability.** A regular intuitive pattern is followed in addressing the key domain area. Different people follow similar procedures to address the same tasks; however, there is neither formal training nor dissemination of procedures.
- **Level 3: Defined Capability.** Procedures related to the key domain area have been defined, documented, and communicated; they are not sophisticated, but rather correspond to the formalization of existing practices. There is formal training to support initiatives related to the key area.
- **Level 4: Managed Capability.** It is possible to monitor and measure procedure fulfillment and compliance, and to take action when the key domain area appears to work ineffectively. And established standards and rules -related to the key area- are applied throughout the organization.
- **Level 5: Integrated Capability (Optimizing).** Procedures related to the key domain area have reached the level of best practices and continuous improvements are applied. The key area is optimized through the use of ICT and it works in an integrated manner with other related areas.

3.3. Relationship between capability of critical variables and key domain areas

The Capability Level is a property of each key domain area; it is a measure of its state of readiness to support the organizational development, and is determined by measuring the capability level of its critical variables.

Each variable within a key area is assessed along seven dimensions: awareness, human capital training, communication within the organization, procedures and practices, compliance with norms and standards, tools and automation support, and staff commitment. The assessment is based on information that the organization provides to support their responses to several questionnaires. There is a questionnaire and a capability scale of 1 to 5 for each variable (55 in total, see Table 1 for an example); the procedure for information gathering and processing is formalized in a methodology and is supported by a Web tool (see Section 4).
Table 1.  
Extract from the capability scale of a critical variable (e.g., variable “Strategy Alignment” of the key domain area “Vision, Strategy and Policy”).

<table>
<thead>
<tr>
<th>Capability Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Vision formulated by the organization’s Senior Management lacks specific reference to e-Government.</td>
</tr>
</tbody>
</table>
| 2                | Senior management has incorporated the adoption of e-Government into the organization’s Vision.  
The organization has an IT Strategy that meets the business operational needs. |
| 3                | The e-Government Strategy is defined and aligned with the organization’s Business and IT Strategies.  
The organization has a Policy that defines how and when to perform the e-Government Strategic Planning and IT Strategic Planning.  
Senior management documents the e-Government and IT Strategies and communicates them to all staff. |
| 4                | The organization’s Vision incorporates directives from the national e-Government Vision.  
There are specific procedures for the Senior Management to monitor the implementation process of the e-Government and IT Strategic Plans. |
| 5                | Strategic Plans and Policies about e-Government and IT are regularly updated, considering information about performance indicators, customers, suppliers and other public agencies that interact with the organization.  
The organization performs benchmarkings against industry standards and these results are incorporated into the e-Government and IT Strategic Planning process. |

Then the capability levels of each variable are weighted according to their importance, and the result of this weighting is the capability level of the key area. In other words, the capability level (CL) of a key domain area (KDA) is the weighted average of the capability levels of its constituent critical variables (CV); as shown in Equation 1.

\[
CL(KDA) = \text{Sum}(CL(CV_1)*W_1, CL(CV_2)*W_2, \ldots, CL(CV_n)*W_n), 
\]

where \( W_i = [0,1] / W_i \in \mathbb{R} \land \sum W_i = 1 \) is the weighting value of \( CV_i \), and \( CL(CV_i) \in \{1,2,\ldots,5\} \)

The importance weighting of each variable within a key area is determined by inspection of international practice and expert opinion; in the Chilean case, the study of e-Government implementation strategies and policies in the international experience (some results in Valdes et al., 2008) and the feedback from expert public officials from the Chilean agency for the development of electronic government (Executive Secretariat of Digital Strategy)\(^6\). Table 2 shows the weights of the variables for the key areas of the domain “E-Government Strategy.”

\(^6\) http://www.estrategiadigital.gob.cl
Table 2.
Weighting values for calculating the capabilities of key domain areas in terms of those of their critical variables (e.g., leverage domain “E-Government Strategy”).

<table>
<thead>
<tr>
<th>Key Domain Area</th>
<th>Critical Variable</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision, Strategy and Policy</td>
<td>Strategy Alignment</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Senior Management Commitment</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>Communication to Stakeholders</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Resource Commitment to eGov</td>
<td>0.3</td>
</tr>
<tr>
<td>Enterprise Architecture Strategy</td>
<td>Implementation Strategy</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>Alignment to Reference Models</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Service Reuse Strategy</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Business Architecture</td>
<td>0.3</td>
</tr>
<tr>
<td>IT Management and Organization</td>
<td>IT Orientation Planning</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>IT Infrastructure Planning</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Organizational Structure Definition</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>IT Process Map</td>
<td>0.3</td>
</tr>
</tbody>
</table>

The weighting process accounts for differences that may exist between the variables within a key area, all variables are important but not equally important. For example, in Table 2 within the key area “Vision, Strategy and Policy,” the variable “Resource Commitment to eGov” has a higher weight than the variable “Strategy Alignment,” because while the latter measures the ability of the organization to elaborate high-level definitions and directives, the former measures its ability to commit actual resources for the e-Government development, then it was considered harder to achieve, and measures more faithfully the real commitment of the organization’s strategy to e-Government. Additionally in Table 2, in the key area “Enterprise Architecture Strategy,” the variable “Alignment to Reference Models” has a slightly lower weight, mainly because the Chilean government still has no official enterprise architecture reference model. Hence, the weighting process conveys a qualitative analysis of several factors (international experience, local reality, and national strategy and policy) that finally takes the form of weights.

3.4. Organizational maturity model

*Maturity Level* (ML) is a property of the organization as a whole. Each ML can be seen as a configuration that corresponds to a group of key domain areas (KDA) that are set to specific capability levels (CLs); as in Equation 2. In other words, the ML is obtained from the CLs of the organization in each KDA.

\[
ML_1 = Config_1(CL(KDA_1),..., CL(KDA_i)) \\
ML_2 = Config_2(CL(KDA_1),..., CL(KDA_j)) \\
... \\
ML_5 = Config_5(CL(KDA_1),..., CL(KDA_k))
\]

This mechanism provides great flexibility, as it allows the evolution of the maturity levels to be aligned with national e-Government implementation strategies and policies, this is possible because the mechanism enables the government to define which key domain areas are higher priorities in a given maturity level (and therefore required for that level); however it also allows each agency to develop the remaining key areas according to their own needs, for example:

- If the government states that it is very important that public agencies interact through centralized interoperability frameworks, then key domain areas such as “Interoperability” and “(Regulatory) Compliance” should be addressed at early
maturity levels and should be taken to the higher capability levels in the advanced maturity levels.

- If the government states that public agencies should start their e-Government initiatives by attracting and retaining the best human capital, then the key domain area “Human Capital” should be addressed at early maturity levels.
- If policymakers state that maintaining enterprise architectures is an advanced aspect (and it is not a priority to the national e-Government strategy), then it will not be necessary to consider the key domain area “Enterprise Architecture Strategy” in the early maturity levels, thereby leaving its implementation to each agency criteria, according to its own business objectives.

The evolving structure of the maturity levels suggests a roadmap for improvements, to be followed in moving up from lower levels of maturity up to level 5 (Optimizing). Table 3 illustrates the key domain areas and their minimum capability level required in each organizational maturity level. In Chile, these settings were determined based on the study of strategies of e-Government implementation in the international experience (some results in Valdes et al., 2008), the study of models and frameworks that describe e-Government evolution (see Section 2.4) and the feedback received from expert public officials of the Executive Secretariat of Digital Strategy, who also validated the feasibility of the improvement roadmaps prescribed by the model.

The current policy environment in which the model was developed and fine-tuned is given by the policies and directives stated in the Chilean “Digital Strategy 2007-2012” (CMDD, 2007) and the “Multiphase Program for the Strengthening of Chile’s Digital Strategy” (IDB, 2003) funded by the Inter-American Development Bank. Both contain policies that were embodied in the maturity level structure of the model. For example, concerning interoperability, current policies are oriented towards providing online services, and to avoid asking citizens for information that the public administration already possess (when providing those services); hence an interoperability platform is currently being built, to enable public agencies to exchange and integrate information coming from different services.

In Chile, a two-phase approach to interoperability is taking place (similar to the approach discussed in Guijarro, 2007): a first phase consisting of enabling interoperability among public agencies, through basic technical standards and policies, interoperability frameworks, and platforms; and a second phase aimed at aligning administrative procedures with technical systems, and intended to enable organizational interoperability between different agencies through the implementation of enterprise architectures. Currently most efforts are directed to the first phase. The model reflects these policies in the roadmaps recommended by the maturity levels; and in the case of interoperability, it suggest that agencies address aspects related to technical interoperability in early maturity levels and aspects related to enterprise architecture in advanced maturity levels.
### Table 3.
Organizational maturity in terms of the capability of priority key domain areas.

<table>
<thead>
<tr>
<th>Leverage Domain</th>
<th>Key Domain Area</th>
<th>ML 1: Initial</th>
<th>ML 2: Developing</th>
<th>ML 3: Defined</th>
<th>ML 4: Managed</th>
<th>ML 5: Optimizing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enterprise Architecture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IT Management and Organization</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>IT Governance</td>
<td>IT Architecture</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Portfolio and Risk Management</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IT Service Delivery</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assets Utilization</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Process Management</td>
<td>Business Process Management</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Performance Management</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Services to Citizen and Business</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interoperability</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compliance</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality and Security Assurance</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Organization and People</td>
<td>Infrastructure and eGov Tools</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge Management</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Human Capital</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Change Management</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

The model is both descriptive and prescriptive. The notion comes from the CMMI model, where organizations can follow the prescriptive roadmap for improvement given by the “staged representation” or follow their own agenda according to the “continuous representation.” An organization can see our model as descriptive if it only measures the capability levels of its key areas, or as prescriptive if it also takes the maturity levels into consideration. The maturity levels embody the government’s view (strategies and policies) about the synchronized evolution of key areas (based in international experiences and local reality), they are the means of the government to establish minimum requirements and priorities to its agencies regarding e-Government; but also agencies are free to advance in other aspects of the model according to their own needs.

In summary: (1) each maturity level frames a group of key areas that are set to defined capability levels; (2) a maturity level establishes an equivalence of e-Government implementation among the organizations that are rated in that level; (3) the maturity model as a whole proposes an improvement roadmap that the organization can follow to climb to higher maturity levels, because once an organization has been evaluated, the model can identify which key areas it needs to address and how much, in order to increase its capability and maturity.

### 4. Methodological framework, enabling roles and institutions

The evaluation methodology associated to the eGov-MM model is called *eGovernment Maturity Evaluation Methodology* (eGov-MEM), and establishes activities, schedules,
institutions, workflows, work products, roles and responsibilities, to provide effective assessments to organizations using the eGov-MM model. The diagram in Figure 3 illustrates the relationships between all the elements involved. EGov-MEM is supported by a Web tool, called the eGovernment Maturity Evaluation Tool (eGov-MET), which supports the gathering and processing of information generated in each evaluation based on the eGov-MM model.

Assessments of the eGov-MM model are organized as projects, i.e., a group of people, during a given period of time and using a certain amount of resources, answers questionnaires and provides information (documents of evidence to support their answers) required by the model. An assessment project is performed on an organization (e.g., a public agency or a sub-unit) and results in an evaluation (capabilities of each key domain area and organizational maturity) plus a proposed capability maturity improvement roadmap.

The users of eGov-MEM and eGov-MET are the members of the Evaluation Team, which is composed of: (1) officials pertaining to the evaluated agency, who participate in the information gathering process as members of the internal team, at least three officials are required to participate, each one representing a management field of the model and responsible for the information gathered in that field; and (2) consultants pertaining to the so-called eGovernment Maturity Accreditation Authority (eGov-MAA).

The eGov-MAA belongs to the local agency in charge of e-Government (in Chile, the Executive Secretariat of Digital Strategy) and must be independent from the agencies to be assessed; nevertheless the actual assessment projects can be commissioned to an external entity, e.g., in our case Universidad Técnica Federico Santa María carries out the assessment projects and the results have to be certified by the Executive Secretariat of Digital Strategy.

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7 As explained in Section 3.1 each field groups a set key domain areas according to the type of management to which they are associated in an organization, there are 6 operational management key areas, 8 IT management key areas, and 3 human capital management key areas.
EGov-MEM specifies procedures in four macro-steps: (1) assessment planning, (2) eGov-MET configuration, (3) information gathering, and (4) information processing. The consultants guide and support the agency’s internal team during steps (1) and (3), and perform steps (2) and (4). The outcomes of the process – capability levels, maturity level, and improvement roadmap – are produced by the consultants during step (4).

The capability level of each critical variable is determined from the information gathered in the agency (answers to questionnaires designed to elucidate the status of the agency regarding the variables and documents of evidence submitted to the eGov-MET tool), and these results are then weighted as explained in Section 3.3 to obtain the capability level of each key domain area. It is with this information that the organizational maturity level is determined as shown in Section 3.4. Finally, the improvement roadmap is proposed according to the resulting capability and maturity levels of the organization and the capability and maturity scales provided by the model. For example, suppose an agency obtained maturity level two and the only reason why it did not achieve maturity level three is because its key area “Vision, Strategy, and Policy” scored capability level two. If the agency wants to move up to maturity level three then it should start by improving this key area up to capability level three, hence the suggestion for the agency is to make sure that all variables of that key area score capability level three, and the necessary aspects the agency must address to achieve this goal are specified in the capability scales of those variables. This analysis is done for the 55 variables, and a report is elaborated by the consultants of the eGov-MAA which is delivered to the agency. In summary, eGov-MEM provides the methodological framework for conducting eGov-MM evaluations, eGov-MET is the tool that supports the methodology, and eGov-MAA provides the institutional framework needed to conduct these evaluations.

5. Validation and replicability

The eGov-MM model was validated and supported with feedback by public officials through a pilot study. The replicability of its measurements is addressed through its evaluation methodology.

5.1. Pilot study

During April 2008, a pilot study was performed on a reduced set of public agencies, with the following objectives: (1) to validate the model and its associated Web support tool, (2) to test the applicability of the model to a broad spectrum of public agencies with different characteristics, and (3) to obtain feedback from public agencies.

A sample of nine heterogeneous agencies was selected (heterogeneous in terms of their function/business, organizational size and degree of technological advancement), all based in the metropolitan area of Santiago, Chile. We divided the set of key domain areas according to three management fields (as described in Section 3.1: operational, IT, and human capital management) and required at least one representative per field from each agency to participate in the pilot study. The Operational Management key areas were assigned to the operating vice-director of the agency, the IT Management key areas to the head of the IT unit, and the Human Capital Management key areas to the head of human resources unit.

The Executive Secretariat of Digital Strategy invited the participants and we organized four workshops to apply the model and obtain their feedback; first an introductory workshop for all the participants, and then three specialized workshops (one for each management field).

8 Table 3 shows that the key area “Vision, Strategy and Policy” must score at least capability level 3 for the organization to obtain maturity level 3.

9 Table 1 shows an extract from a capability scale of one of the variables of the key area “Vision, Strategy and Policy,” there the agency can look at the elements that characterize an organization that scores capability level 3.
where the participants applied the model to assess their agencies. During the workshops we received feedback about the model, the Web tool usability, and the assessment methodology. The gathering and processing of information was performed as described previously in Section 4 (capability and maturity results of participating agencies were not reported, as the purpose of the pilot study was to validate the model and receive feedback, not to get official scores).

During the workshops the participants validated the model structure, applicability, and its capability and maturity calculation scheme. Furthermore, on a scale of 1 to 4, 89% of the critical variables in the model were considered to have a relevance level of high or very high (levels three and four), as the factors to be measured for e-Government. The IT Management field case is particularly notable, with the participation of heads of IT units; their relevance perception was 96%. In addition, based on the feedback received, we made improvements to the structure of leverage domains, key domain areas and critical variables (e.g., merging and splitting some variables) and we could improve usability aspects of the Web tool (e.g., improving the ease of movement across different questionnaires).

5.2. Replicability

The replicability of the measurements and assessments of capability maturity models is achieved through the generation of a methodological instrument. In other words, the model’s construction is not responsible for preventing any erroneous interpretations that could produce erroneous results; instead, the international practice is to design a methodology for applying the model that is appropriate to obtain repeatable measurements.

This is, for example, the case of CMMI (SEI, 2006a) with the SCAMPI (Standard CMMI Appraisal Method for Process Improvement) assessment methodology (SEI, 2006b) and MoProSoft (SEM, 2005a), which has EvalProSoft (Process Assessment Method for Software Industry) (SEM, 2005b). ISO/IEC 15504 provides a framework for process capability assessment; it originally contained a software process model (in its original 1998 version, ISO/IEC, 1998), but eventually this was removed and replaced by an external reference process model (e.g., ISO/IEC 12207, Information Technology - Software Life Cycle Processes) so that the evaluation standard is applicable to any IT process model. Thus, the international practice is to separate the model containing best practices from the assessment model.

The approach taken in this research was to consider the particular assessment needs of the eGov-MM model (e.g., institutional framework) and to follow the best assessment practices described in the classical maturity models’ initiatives (i.e., SCAMPI, ISO/IEC 15504, also EvalProSoft), and other initiatives such as Cresswell et al. (2006) and Cresswell et al. (2007). It is expected that rigorous application of the good practices contained in the eGov-MEM methodology (see Section 4) will result in replicable assessments.

6. Application of the model

In June 2008, we applied the eGov-MM model to a selection of 30 public agencies, representing nearly 10% of central Chilean government agencies. This application involved the participation of nearly 100 public officials. We followed the methodology presented in Section 4.

6.1. Public agencies maturity and ranking

Each agency individually received the results of the evaluation, i.e., the capability level of each key domain area, organizational maturity level, and a proposed capability maturity improvement roadmap, based on the capability models of each of the 55 critical variables.
Table 4 shows the organizational maturity level achieved by each agency. To determine the ranking of the public agencies, two criteria were used:

- First, the **absolute maturity level**, i.e., public agencies were grouped according to the levels provided by the model, based on minimum capability levels required in each organizational maturity level (see Section 3.4).
- Then, agencies within each absolute maturity level were sorted by **percentage maturity**, i.e., the sum of all their key domain area capability divided by the total possible capability.

### Table 4.
Maturity rankings of public agencies.

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Agency</th>
<th>ML (Absolute)</th>
<th>Percentage Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IRS (Internal Revenue Service) <a href="http://home.sii.cl/">http://home.sii.cl/</a></td>
<td>3</td>
<td>74%</td>
</tr>
<tr>
<td>2</td>
<td>Undersecretary of Housing <a href="http://www.minvu.cl/">http://www.minvu.cl/</a></td>
<td>2</td>
<td>58%</td>
</tr>
<tr>
<td>3</td>
<td>Department of the Treasury <a href="http://www.tesoreria.cl/">http://www.tesoreria.cl/</a></td>
<td>2</td>
<td>55%</td>
</tr>
<tr>
<td>4</td>
<td>AIC (Agency of International Cooperation) <a href="http://www.agci.cl/">http://www.agci.cl/</a></td>
<td>2</td>
<td>54%</td>
</tr>
<tr>
<td>5</td>
<td>Agriculture and Cattle Service <a href="http://www.sag.cl/">http://www.sag.cl/</a></td>
<td>2</td>
<td>53%</td>
</tr>
<tr>
<td>6</td>
<td>National Consumer Service <a href="http://www.sernac.cl/">http://www.sernac.cl/</a></td>
<td>2</td>
<td>53%</td>
</tr>
<tr>
<td>7</td>
<td>Undersecretary of the Navy <a href="http://www.subsecmar.cl/">http://www.subsecmar.cl/</a></td>
<td>2</td>
<td>53%</td>
</tr>
<tr>
<td>8</td>
<td>National Health Fund <a href="http://www.fonasa.cl/">http://www.fonasa.cl/</a></td>
<td>2</td>
<td>52%</td>
</tr>
<tr>
<td>9</td>
<td>South East Metropolitan Health Service <a href="http://www.ssmso.cl/">http://www.ssmso.cl/</a></td>
<td>2</td>
<td>52%</td>
</tr>
<tr>
<td>10</td>
<td>Higher Education Council <a href="http://www.cse.cl/">http://www.cse.cl/</a></td>
<td>2</td>
<td>51%</td>
</tr>
<tr>
<td>11</td>
<td>Institute of Public Health <a href="http://www.ispch.cl/">http://www.ispch.cl/</a></td>
<td>2</td>
<td>49%</td>
</tr>
<tr>
<td>12</td>
<td>Medical Forensic Service <a href="http://www.sml.cl/">http://www.sml.cl/</a></td>
<td>2</td>
<td>49%</td>
</tr>
<tr>
<td>13</td>
<td>Board of Student Aid and Scholarships <a href="http://www.junaeb.cl/">http://www.junaeb.cl/</a></td>
<td>2</td>
<td>48%</td>
</tr>
<tr>
<td>14</td>
<td>Undersecretary of Telecommunications <a href="http://www.subtel.cl/">http://www.subtel.cl/</a></td>
<td>2</td>
<td>47%</td>
</tr>
<tr>
<td>15</td>
<td>Superintendence of Electricity and Fuels <a href="http://www.sec.cl/">http://www.sec.cl/</a></td>
<td>2</td>
<td>45%</td>
</tr>
<tr>
<td>16</td>
<td>Superintendence of Social Security <a href="http://www.suseso.cl/">http://www.suseso.cl/</a></td>
<td>2</td>
<td>42%</td>
</tr>
<tr>
<td>17</td>
<td>TES (Training and Employment Service) <a href="http://www.sence.cl/">http://www.sence.cl/</a></td>
<td>1</td>
<td>54%</td>
</tr>
<tr>
<td>18</td>
<td>ISW (Institute of Social Welfare) <a href="http://www.ips.gov.cl/">http://www.ips.gov.cl/</a></td>
<td>1</td>
<td>51%</td>
</tr>
<tr>
<td>19</td>
<td>Customs Service <a href="http://www.aduana.cl/">http://www.aduana.cl/</a></td>
<td>1</td>
<td>49%</td>
</tr>
<tr>
<td>20</td>
<td>Directorate of Civil Aviation <a href="http://www.dgac.cl/">http://www.dgac.cl/</a></td>
<td>1</td>
<td>48%</td>
</tr>
<tr>
<td>21</td>
<td>Technical Cooperation Service <a href="http://www.sercotec.cl/">http://www.sercotec.cl/</a></td>
<td>1</td>
<td>46%</td>
</tr>
<tr>
<td>22</td>
<td>National Emergency Office <a href="http://www.onemi.cl/">http://www.onemi.cl/</a></td>
<td>1</td>
<td>44%</td>
</tr>
<tr>
<td>23</td>
<td>Undersecretary of Planning <a href="http://www.mideplan.cl/">http://www.mideplan.cl/</a></td>
<td>1</td>
<td>44%</td>
</tr>
<tr>
<td>24</td>
<td>National Energy Commission <a href="http://www.cne.cl/">http://www.cne.cl/</a></td>
<td>1</td>
<td>41%</td>
</tr>
<tr>
<td>25</td>
<td>National Fishery Service <a href="http://www.sernapesca.cl/">http://www.sernapesca.cl/</a></td>
<td>1</td>
<td>40%</td>
</tr>
<tr>
<td>26</td>
<td>Directorate of Airports <a href="http://www.aeropuertos.gov.cl/">http://www.aeropuertos.gov.cl/</a></td>
<td>1</td>
<td>39%</td>
</tr>
<tr>
<td>27</td>
<td>Undersecretary of Labor <a href="http://www.mintrab.cl/">http://www.mintrab.cl/</a></td>
<td>1</td>
<td>39%</td>
</tr>
<tr>
<td>28</td>
<td>Chilean Gendarmerie (Prison Guards) <a href="http://www.gendarmeria.cl/">http://www.gendarmeria.cl/</a></td>
<td>1</td>
<td>38%</td>
</tr>
<tr>
<td>29</td>
<td>Undersecretary of Foreign Affairs <a href="http://www.minrel.cl/">http://www.minrel.cl/</a></td>
<td>1</td>
<td>38%</td>
</tr>
<tr>
<td>30</td>
<td>Undersecretary of Regional and Administrative Development <a href="http://www.subdere.cl/">http://www.subdere.cl/</a></td>
<td>1</td>
<td>33%</td>
</tr>
</tbody>
</table>

| Average  | 2 | 48% |

The average organizational maturity level of the Chilean public system is two (*developing*). The IRS stands out as a leader and the only one who scored maturity level three. Also, there are no agencies at levels four and five, 3% are at level 3 (IRS), 50% are at level two, and 47% are at level one.

The percentage maturity gives an overview of the necessary conditions for each agency to move up from one maturity level to the next (details are obtained by analyzing the capability levels of the required key domain areas for each maturity level). Thus, it can be observed that the best prepared agencies to move from maturity level one to level two are: the TES, the ISW and Customs. The agencies in better shape to move from maturity level two to level
three are the Undersecretary of Housing, the Department of the Treasury and the AIC. The three agencies with the most improvement needs for e-Government readiness are the Gendarmerie, the Undersecretary of Foreign Affairs and the Undersecretary of Regional and Administrative Development.

6.2. Analysis of key domain areas

Table 5 shows the average capability level of each key domain area in the selection of public agencies that participated in the application of the model; 16 of the 17 key areas did not reach level three (defined capability).

Table 5.
Average capabilities of key domain areas.

<table>
<thead>
<tr>
<th>Key Domain Area</th>
<th>Average Capability Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interoperability</td>
<td>3.20</td>
</tr>
<tr>
<td>Services to Citizen and Business</td>
<td>2.70</td>
</tr>
<tr>
<td>IT Architecture</td>
<td>2.67</td>
</tr>
<tr>
<td>IT Service Delivery</td>
<td>2.63</td>
</tr>
<tr>
<td>Infrastructure and eGov Tools</td>
<td>2.63</td>
</tr>
<tr>
<td>IT Management and Organization</td>
<td>2.47</td>
</tr>
<tr>
<td>Performance Management</td>
<td>2.43</td>
</tr>
<tr>
<td>Compliance</td>
<td>2.40</td>
</tr>
<tr>
<td>Assets Utilization</td>
<td>2.37</td>
</tr>
<tr>
<td>Quality and Security Assurance</td>
<td>2.30</td>
</tr>
<tr>
<td>Change Management</td>
<td>2.30</td>
</tr>
<tr>
<td>Vision, Strategy and Policy</td>
<td>2.23</td>
</tr>
<tr>
<td>Enterprise Architecture Strategy</td>
<td>2.20</td>
</tr>
<tr>
<td>Portfolio and Risk Management</td>
<td>2.20</td>
</tr>
<tr>
<td>Knowledge Management</td>
<td>2.10</td>
</tr>
<tr>
<td>Business Process Management</td>
<td>2.07</td>
</tr>
<tr>
<td>Human Capital</td>
<td>1.83</td>
</tr>
</tbody>
</table>

The more developed key domain areas are (1) “Interoperability Practices,” which is measured through the variables organizational, semantic and technical interoperability, as defined in IDABC (2004) (Figure 2 shows the variables of each key area); and (2) “Services to Citizens and Business,” which is measured through the variables online services, public information system and electronic channels quality. These results can be explained by the emphasis of the Chilean digital strategy (CMDD, 2007) and policy context in recent years, whose primary purpose has been to advance towards the integration of public services through interoperability infrastructure, and to implement online public services for citizens.

On the other hand, the less developed key domain areas are (1) “Business Process Management” (its variables are process modeling, simulation, monitoring and accountability) and (2) “Human Capital” (its variables are e-Government competency management, people recruitment and retention, and education and development). These results support the hypothesis that the efforts to introduce ICT in the public sector are not coupled with the required formalization of business processes and development of human capital (this usually results in inefficient use of resources and ineffective additional efforts by staff).

Based on the contents of the eGov-MM model (the vast amount of information specified in the capability scales of each critical variable) and its evolutionary structure, specific recommendations can be made for progress on issues of lower capability level. For example, to advance the key domain area “Human Capital” to capability level three (now close to level two nation-wide), one of the model’s recommendations is to encourage public agencies to implement competence management systems to identify staff training and recruitment needs with respect to electronic government, and to
integrate them efficiently with their educational, development, retention and staff evaluation systems; educational and development needs identified by these systems could be met, for example, through agreements with universities and institutes in specialization programs and specific training on competences required for the development of e-Government projects.

6.3. Lessons learned and recommendations

From the application of the model we have several lessons learned and recommendations we deem valuable to share. First, pilot testing and validation from public officials were essential; these enabled us to improve the model based on the feedback from experienced officials and allowed us to enhance the model applicability. Also, these activities allowed us to train ourselves and gain practical experience for the subsequent official application of the model.

Second, the model’s construction should not be responsible for preventing any erroneous use; instead, the international practice is to design a separate methodology for applying the model which should be rigorous enough to allow obtaining repeatable measurements. In addition, a proper institutional framework design is fundamental to achieving effective measurements and comparable scores between agencies.

Third, central government sponsorship was crucial to engage public agencies to participate (nearly a 100 public officials from 30 agencies). Particularly important was the sponsorship of the Executive Secretariat of Digital Strategy from the Ministry of Economy, who collaborated and endorsed every aspect of the project, from fine-tuning of the model to engaging agencies in the pilot study and in the official application.

Fourth, considering national strategic direction and policy context besides international experience was essential in order to obtain a model that is applicable to the local reality.

As purely operational aspects we must underscore the importance of maintaining a call center during the assessments to assist public agencies, performing introductory workshops and training about the model, and organizing the assessment work in each agency as a project (as described in Section 4).

Overall, results from the model’s application suggest that the introduction of ICT into government services is not synchronized with the formalization of the underlying business processes and the development of the required human capital. Based on these results, we recommended that the government revise the national strategy in a way that incorporates policies and programs oriented towards the improvement of business process management and human capital capabilities. In particular, the government should develop policies to support improvement in the areas of: process modeling, simulation, monitoring and accountability; and e-Government competency management, people recruitment and retention, and education and development. Effective policies can be formulated from these recommendations, and by considering the detailed roadmaps specified by the model and the international experience related to successful e-Government policies, guides and standards (such as the initiatives discussed in Gil-García & Pardo, 2005). Individually, each agency should consider its particular results, proposed improvement roadmaps, business needs, and nation-wide directives as inputs for developing policies that further its e-Government preparedness.

7. Conclusions

Governments worldwide are encouraging public agencies to join e-Government initiatives in order to provide better services to their citizens; hence the need arises to measure the e-Government preparedness of public agencies. In response, a maturity model has been developed, called eGov-MM. The model integrates the assessment of several technological,
organizational, operational, and human capital capabilities that should be considered in relation to e-Government, incorporates a structure of 4 Leverage Domains, 17 Key Domain Areas and 55 Critical Variables, and is accompanied by a methodology and an institutional framework that standardize its application and enable rigorous, effective and replicable measurements and assessments.

The structure, approach, content, and tuning of the model are inspired by:
1) The international experience with respect to governmental, academic, and evolutionary e-Government models; classic capability maturity models; special-purpose models (that address related issues); and e-Government implementation strategies; and
2) The national situation and policy context, supplemented with expert opinion and workshops with local public officials.

The configuration and calculation mechanism of maturity and capability levels makes the model adaptable to new international trends and national e-Government implementation strategies and policies.

The model distinguishes between capability, a characteristic of each key domain area, and maturity, a property of the organization as a whole. The capabilities of the critical variables contribute in a weighted fashion to those of a key area, and in turn, each maturity level corresponds to a group of key areas set to defined capability levels. When taken together, the set of maturity levels constitute an improvement roadmap that organizations can follow in order to move up from lower to upper levels.

EGov-MM was validated and feedback was given by public officials through a pilot study. Subsequently, it was applied to a selection of 30 public agencies. The average organizational maturity level of the Chilean public system is two (developing). The more developed key domain areas are “Interoperability” and “Services to Citizens and Business.” The least developed key domain areas are “Business Process Management” and “Human Capital.” These results support the hypothesis that the efforts to introduce ICT into business processes are not coupled with the formalization of these processes and the human capital development required.

The first extensive application of the model provided each agency with information that can support their strategic and tactical management, thus enabling public agencies to (1) identify key areas to develop their e-Government strategies and policies, (2) know their capability levels in relevant areas for service delivery to citizens, (3) determine the maturity level of their organization, and (4) articulate a development strategy for their capabilities for the continuous improvement of their maturity degree (improvement roadmaps). In addition, overall guidance and action plans were given as inputs to be considered for the national e-Government strategies and policies.

Consequently, the model proved to respond adequately to the needs that motivated its development, to become a useful tool for the government to assess the preparedness of public agencies to join the new national e-Government directives. As international trends and national reality change, the model must continually be retuned for maintenance, through its mechanisms of critical variable importance weighting and configuration of capability and maturity levels. Thus, the model can be adapted to new requirements and even to the different situations of other countries. Additional applications of the model must be performed, with the objective of providing the government with valuable information on the status and progress of the maturity levels of public agencies.
References


