

Toward an Enabler-Based Digital Government Maturity Framework: A Preliminary Proposal Based on Theories of Change

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ABSTRACT

Digital government has been seen as a strategy to improve public services, foster engagement with citizens, and modernize government agencies. Regardless of the recognition of this important role in government transformation, there is no consistent evidence in terms of the determinants and results of digital government strategies. More specifically, there is no clarity about what leads to successful digital government initiatives. Stage-based maturity models have been used to better understand the current situation of digital government in terms of results. They are also seen as useful in helping to understand the resources and capabilities of government agencies and how they contribute to successful digital government projects. However, existing maturity models have been criticised due to their lack of theory, oversimplification of reality, and linear thinking. In an attempt to overcome some of these shortcomings, this paper proposes what we call an enabler-based digital government maturity model. Our proposed model not only argues for a multidimensional view, but also suggests how to think about specific mechanisms of impact. By specifying the mechanisms of influence, our proposal starts a necessary conversation about maturity models and the potential complementarity of stage-based and enabler-based approaches.

CCS CONCEPTS

• Applied computing → Computers in other domains → Computing in government → *E-government*

KEYWORDS

maturity model, e-government, comparative analysis.

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1. INTRODUCTION

Digital government maturity models are helpful tools for agencies to diagnose their ability to use information technologies to improve performance and prepare strategies and action plan to move toward a desired stage of technology appropriation. A strong maturity model provides a desired state and recommendations that help accelerate the adoption of information technologies toward that desired stage. Most information technology maturity models focus on guiding organizations toward advanced stages of technology appropriation by providing a rich description of what technology appropriation looks like in each stage. Therefore, most existing models focus on conceptualizing and describing each stage [1, 18, 19, 28, 32, 38, 43, 44], and several literature reviews have compiled and synthesized these stages [4, 15, 29, 34]. These models are typically referred as "stage-based models" or "stage of growth models".

Maturity models are also the basis for maturity assessment frameworks, which organizations often use to diagnose their use of information technologies [3, 10, 30]. Considering the gap between the assessment and certain stages in the model "recommendations for improvement measures can be derived and prioritized in order to reach higher maturity levels" [3]. Despite some important criticisms [4, 13, 14], maturity models have been

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a favoured tool for organizations and are an evergreen research topic in digital government and information systems. Since their emergence in the 70's [33], maturity models have been published with regularity over a wide variety of fields [9, 15, 17, 29]. Given the existence of an increasing number of maturity models, users must find ways to identify the strongest or most reliable models for their purposes [34].

Stage-based models help provide a diagnosis and a path to follow for improving an organization's overall performance and competitiveness. Recommendations resulting from an assessment, however, are often weakly grounded in theory or empirical evidence [4, 7, 14, 23, 26, 30]. These blind-spots result from the emphasis (in many models) on conceptualizing the models' stages, while paying little attention to the organizational structures and processes that are changed by the adoption of technologies and the specific mechanisms behind such changes.

Strong recommendations, based on such assessments, must be accompanied by a clear, and theoretically and/or empirically grounded explanation of why the adoption of information technologies evolves the way it does (or the way the maturity model says it will). We argue that the conceptualization of enablers in maturity models can help overcome this weakness. Conceptualizing enablers means identifying the theories of change that explain how and why the adopted technology is expected to transform different structures and processes of the organization and help accomplish its overall goals. Understanding the theories of change beneath the maturity models may also reveal the enabling factors for accelerating technology appropriation in the public sector. This enabler-based approach moves the idea of maturation to the centre of the conceptualization, and seeks to establish clear mechanisms upon which recommendations can be grounded. That doesn't mean that stage and enabler approaches are mutually exclusive; on the contrary, both are essential for a strong maturity model.

Our empirical analysis seeks to understand what theories of change are implied in the literature of digital government maturity models, and how they are specified. To do so, we used an interpretive approach to extract the dimensions and related theories of change from three digital government maturity models. Specifically, we did open coding on the documents available from each case to develop categories for enablers, and then we revisited the documents to validate or re-assign the categories created. We selected three cases that met the inclusion criteria (Gartner's Digital Government Maturity Model, McKinsey's Digital by Default, and United Nations METER 2). Our inclusion criteria were maturity models for digital governments with a rich description of the organizational areas expected to change along with the maturity stages, and available through academic repositories. Compared to other maturity models, these cases have a rich description of how diverse organizational dimensions change when trying to achieve advanced maturity stages.

This paper is organized in seven sections, including the foregoing introduction. Section two reviews the current literature on stage-based models and some related critical perspectives. Section three presents the methodology used for extracting the

implicit (or explicit) enablers in the cases studied. For each case, we describe their dimensions and enablers. We synthesize the findings from the three cases in a single set of enablers, on what we define as the Enabler-Based Digital Government Maturity Framework (EDGMF). Our framework focuses on dimensions, rather than stages, and intends to give clarity on the theories of change for each dimension. Section six proposes some implications and revisits the study's research motivation in the light of the empirical results. Finally, section seven presents our conclusions and a future research agenda.

2. LITERATURE REVIEW

A maturity models is a sequence of stages that "represent an anticipated, desired, or typical evolution path of [an organization] shaped as discrete stages." [3]. These models help organizations by revealing their position in comparison with the capabilities and other resources needed to achieve the organization's goals [3, 42]. In particular, information technology maturity models seek to exploit the opportunities offered by technologies to improve the organizations' performance [3, 10, 22]. These models provide a sense of focus and direction to the organization's improvement strategies and help as the basis for assessing the current positioning towards desired advanced stages of technology adoption and use.

Most maturity models are designed to describe each maturity stage. A stage is a snap-shot that describes the expected organization's resources, capabilities and operations for each level of maturity. Stage snap-shot serve as a reference for comparing the current organizational stage with the desired stage, and subsequently plan investments in information technologies and their corresponding implementation accordingly [4, 5, 9, 27].

Along the way, information systems maturity models have received criticisms over some perceived flaws [4, 5, 7, 10, 14, 22, 23, 26, 29]. For example, critics point out the lack of methodological rigor and empirical validation in the conceptualization of stages [10, 14, 22, 26, 27]. Further, the common "evolutionary" perspective of the models, where the features of each stage are pre-requisites of the next stage's features often lacks empirical validity [3, 26, 27]. Critics have also noted that the digital government maturity models are typically accurate in describing the early stages, but empirical accuracy drops in later stages. Further, later models are mostly based on an scenario idealized by the authors of the model, yet to be empirically observed [13, 39].

Although case studies have been growing recently, most maturity models have not been subjected to empirical testing [4]. Some scholars have proposed a methodological blend between empirical observation and design science for strengthening the validity of maturity models [10, 26, 30, 35]. Yet, design science applied to maturity models, particularly when the latter are heavily technology-focused, could cause them to become obsolete as new technologies emerge [14, 23, 27].

Critics also emphasize that sound theoretical bases are missing in many maturity models [7, 14, 26, 30, 34]. As explained by Poepplbuss et al. [34], "maturity model designers should, to a greater extent, refer to the existing body of theoretical knowledge

for defining both the maturing entity and the rationale of maturation.” This is a clear reference to the need for a better understanding about what makes organizations advance the maturity stages and how. Despite extensive research on organizational change, most maturity models are silent on maturation agents. Discussion about maturation agents or enablers is limited. Deboi & Bamisesi [14], for example, argue that most of the models implicitly assume that the primary driving force for organizational change is the managers.

Most of existing maturity models are uni-dimensional. This means that the conceptualization and description of the stages treats the organization as a single unit, rather than decomposing it into organizational dimensions or units (for example, institutions, technologies, governance mechanisms, managers) [10, 27]. Therefore, most of the maturity models only provide a general description for each stage [1, 18, 19, 28, 32, 38, 43, 44], whereas some provide a description of how different dimensions (e.g., leadership, technology, governance mechanisms) of the organizations look in every stage [45–47]. For example, Table 1 presents the conceptualization of a stage-based model [29].

Table 1: Lee’s Maturity Model

Stage	Description
Integration	Assimilates (or replicates) processes and services in the information space with the ones in the real world.
Streamlining	Reform the processes and services in the real world to match the information space requirements, fitting for efficiency.
Transformation	Change the shape and scope of processes and services in the information space as well as the ones in the real world, fitting for effectiveness.
Process Management	Processes and services in both worlds are synchronously managed, reflecting citizen involved changes with re-configurable processes and services.

2.1. Enabler-Based approach

To address some of the criticisms presented above, we propose an approach that emphasizes the maturity enablers. The focus of an Enabler-Based Digital Government Maturity Framework (EDGMF) is on identifying and explaining the theories of change for the mechanisms that can advance the maturity stages of an organization.

To conceptualize the enablers, we borrowed the concept of theory of change from evaluation studies [8, 36, 41]. A theory of change is an explanation about “how and why the program will work” [41]. A theory of change pre-specifies how some activities will lead to the desired organizational changes, and identifies the contextual conditions to do so [36]. Ultimately, the value of a good theory of change is rooted in good theory [41], but most

importantly, a good theory of change should be plausible (supported by evidence and logical consistency), operable (the organization can carry out actions with the available resources), and testable [36].

An enabler is the force that triggers “development towards the better” [4]. Metaphorically, an enabler can be thought as a maturing agent² that helps organizations improving the critical factors behind the performance of digital government. Technological maturity could be seen as a natural consequence of organizational growth, or it can be induced through targeted interventions in diverse areas of the organization. An enabler or maturation agent can be any organizational asset (including resources and capabilities), as long as the model explains, and justifies, how and why the asset is advancing the organization towards advanced maturity stages. Some of the enablers discussed in the literature of digital government are management, institutions, governance networks and collaboration, and technologies. Conversely, the theory of change is the explanation that makes each enabler a relevant target for acting, in the context of the maturity model.

3. METHODOLOGY

This section briefly describes the methodology we followed for data collection and analysis. It includes a description of the sample and analytical strategy.

Sample. For the analysis, we considered the maturity models reviewed by Poepelbuss et al. [34] and Fath Allah et al. [15], which combined analysed 56 maturity models. Then, we selected cases based on our inclusion criteria:

- 1) Digital Government. We included maturity models for information technologies adoption in governments (at the national, state or local levels).
- 2) Dimensions. We included models with an explicit description of the organizational areas expected to change along with the maturity stages. For example, the Gartner model provides a snapshot on how “leadership” changes for each stage.
- 3) Availability. All government maturity models were searched and retrieved through several academic repositories. However, some models (especially proprietary models) were not available during the analysis period.

After screening the maturity models, we identified 27 models, published between 2000 and 2012. From these models, only three met the remaining two criteria: 1) Gartner’s Digital Government Maturity Model, 2) McKinsey’s Digital by Default, and 3) United Nations’ METER 2. The data collected for the analysis was composed by documents (either journal articles, grey literature, business reports, and/or business websites) that described the features of the government maturity model.

² We used the term “maturing agent”, but related terms may be found in the literature. For example, “advancing,” “maturation,” “digital transformation,” “enabling mechanisms”, etc.

Analysis. We conducted our analysis in two steps. In the first step, we reviewed the overall descriptions of the maturity model goals and a definition for each of the dimensions in the maturity model. In the second part, we interpreted the contents of the documents to extract the factors that we considered "enablers." This is, subjects of policy intervention (i.e. regulatory framework) that would likely need a change in order to transform the digital government services. Then, for each enabler of digital transformation, we identified a theory of change that explains how the enabler contributes to the development of digital government in light of the overall government priorities.

We extracted each enabler in two rounds of qualitative analysis. In the first round of review, we used open coding to develop categories related to our definition of "enablers." The categories developed in this stage were "data", "monitoring", "third-party service delivery", "leadership", "laws", "institutional arrangements", "organization networks", and "ICT". Then, we reviewed the documents to validate or re-assign the categories developed during the first stage. We concluded our qualitative analysis when all data instances satisfactorily fit into one of the categories developed.

Based on the qualitative analysis, we developed the Enabler-Based Digital Government Maturity Framework. This framework has a set of dimensions that reflect the key government functions that must be transformed to improve the maturity level. Each dimension represents a key maturation enabler (although it can have more than one theory of change). For each dimension, we defined the dimension and its key theories of change. Each dimension can be decomposed into a variety of sub-dimensions. For example, leadership can be broken down into mobilizing innovation and mobilizing collaboration. Each sub-dimension should have its own theory of change and be consistent with the dimension's theory of change. Notwithstanding, discussing sub-dimensions is beyond the scope of this article.

4. CASES ANALYZED IN DETAIL

This section briefly describes each of the cases and analyzes them in terms of the dimensions and enablers they include, either implicitly or explicitly.

4.1. McKinsey's Digital by Default

The main goal of the McKinsey Model is improving citizen's experience when interacting with government [45]. McKinsey's Model emphasizes the benefits of efficiency in public service delivery, accuracy in decision-making and public trust through data sharing and cybersecurity principles. It also balances organizational features with technology innovation.

Dimensions. The McKinsey Model is composed of five dimensions: services, processes, decisions, data sharing, and cybersecurity.

Services looks at the technologies used for public service delivery. The evolutionary perspective in this dimension is that technologies serve as means to simplify and automate the government's interaction with citizens and businesses.

Processes refers to all organizational processes that are behind any public service delivered. This dimension distinguishes digitized and analog operations, relating the former as desirable and the latter as inefficient.

Decisions is a dimension that describes the barriers of limited or imprecise information and complex problems (i.e. wicked problems) for decision-making. Thus, the stages perspective describes precision on the topic of interest, on the capacity for predictive immediate reaction policies, or personalized public services.

Data sharing describes a set of government actions towards unifying registries, linking open data, and standardizing open data policies from multiple entities such as government and non-government organizations. Cybersecurity is a challenging consequence of the digitization of public services and data sharing, which jeopardize the security of sensitive and valuable information in government's hands. As the availability of big data increases, cybersecurity is becoming a key factor contributing to citizen trust in government. Assuming that it is not possible to build defenses against every possible cyber-attack, governments must prioritize their information assets and build appropriate defense strategies around them.

Table 2: Dimensions in McKinsey's Model

Dimension	Description
Services	Technologies used to simplify and automate government's interaction with citizens and businesses.
Processes	The digitalization of all back end processes behind public service delivery.
Decisions	Decision-making based on technologies for predictive data analytics. The goal is to integrate a system that produces data from multiple sources and uses algorithms to refine the accuracy of the insights for the public managers.
Data-sharing	Actions for unifying and linking open data to make it valuable for government or citizen's use.
Cybersecurity	Actions to safeguard sensitive and valuable information exposed by the digitization of public services and data sharing.

Enablers. The McKinsey's Model has four enablers: strategy, governance, leadership and technology. Strategy is a plan for coordinated action that sets the direction of the digital government as a constitutive element of the overall government priorities. The theory of change is that the strategy must link technological opportunities available as solutions for the overall government priorities.

Governance could be seen as the organizational capability that helps government departments and agencies to jointly accomplish strategic goals. The theory of change is all about coordination. Mechanisms of inter-organizational coordination strengthen the diffusion of new policies and technologies across all organizations involved.

Leadership refers to the ability of public managers to lead other members of the organization to make a concerted effort towards a common goal. In this dimension, the theory of change is three-folded. Leaders help to maintain the link of the strategy with the

government priorities. Also, leaders promote goals by overseeing the hiring and development of talent, as well as the continuous monitoring. Finally, leaders promote innovation, which is key for organizational change and advancing maturity stages.

Finally, technology indicates the replacement of information technologies by newer ones. Replacement helps advancing maturity stages by blending a fast transition in the front-end technologies with a slow transition in the back-end, known as the "two-speed IT mode."

Table 3: Enablers in McKinsey's Model

Enabler	Theory of change
Strategy	A good strategy weaves clearly the opportunities that emerging information technologies offer to address some of the overall government priorities.
Governance	Mechanisms of inter-organizational coordination strengthen the diffusion of new policies and technologies across government agencies.
Leadership	Helps cementing the alignment of the strategy within government priorities, oversees the required talent and coordinated effort required for its implementation, and promotes innovation and organizational change.
Technology	A smooth replacement of old IT systems with emerging technologies sets the basis for delivering better public services.
Data	Getting more data from multiple sources helps overcoming the problem of limited information and helps facing complex problems by providing more data from multiple sources.

4.2. Gartner's Digital Government Maturity Model

The Gartner Digital Government Maturity Model focuses primarily on public service delivery [46]. It is a technology-driven model (with emphasis on data) that assumes no resistance in the user acceptance and use of technology, as well as the pre-existence of the regulations needed for making technology work. Overall, the stages describe the desired stage as an improved convenience and choice of public service delivery, an extended and cohesive network of providers, partners and user of public services, and an intense use of big data for prediction customization of service's needs.

Dimensions. The Gartner Model is composed of six dimensions: value focus, service model, platform, ecosystem, leadership and technology. Service model describes four principles of public service delivery that government should follow:

- 1) Convenience and choice. Citizens value having alternatives to the traditional physical office to access public services. This can be achieved by increasing entry points and improving their accessibility or ease of use.
- 2) Third-party intermediation. This is an "external" alternative to increase convenience and choice for citizens in public service delivery. According to the model, third-party intermediation may also increase government's legitimacy by incorporating non-

government actors into public service delivery networks. Third-Party intermediation is assumed to become possible as the availability and usability of government data increases.

- 3) Prediction. Government's ability to foresee an incident that will require government intervention (e.g., preventive health care or preventing traffic jam). Prediction is expected to be possible as the availability and use of big data grows, and as predictive models (e.g., machine learning) are used more intensively.
- 4) Customization. Government's ability to treat each citizen with equity, rather than equality. This means that the government is able to distinguish the diverse needs from individuals and react based on those differences ---relinquishing the one-size-fits-all approach. The assumption is that customized public services or customized law enforcement are possible with the increase of big data. Individual customization is possible through technologies such as wearable sensors or IoT-equipped environments.

Table 4: Dimensions in Gartner's Model

Dimension	Description
Value focus	Democratic values that government prioritizes. For example, efficiency, openness, and transparency.
Service	Describes four principles of public services delivery that government can follow: convenience and choice, intermediation, prediction, and personalization.
Platform	Government's set of IT supporting the chosen service model. This dimension emphasizes the diversified production of big data (e.g., internal, outsourced, or crowd-sourced) to advance maturity.
Ecosystem	The set of stakeholders of public service delivery. For example, contractors, partners, and users.
Leadership	Jurisdiction-wide leadership that coordinates members of the organisation to achieve digital transformation.
Technology focus	Describes the desired technological features of a data-driven technology strategy.

Enablers. The Gartner Model has three enablers: data, monitoring and third-party service delivery. Data refers to the production and use of big data for the achievement of the organizational values. Initiatives such as open data help the government move forward in terms of transparency and openness. Monitoring is the capacity from sensors, data mining and data analytics to measure and monitor activities or events that were not possible before. By enabling measurement, government can set up or expand performance management systems or improve their emergency response systems, among other possibilities. Finally, the distribution of responsibilities across non-government actors improves citizen convenience and choice when accessing public services.

Table 5: Enablers in Gartner's Model

Enabler	Theory of change
Data	The production and use of data help to accomplish organizational values, such as efficiency, openness, transparency, proactivity, and resilience.
Monitoring	Data production technologies (i.e. sensors) and data mining techniques (e.g., web scraping or social network analysis) improve the organization's monitoring capabilities. These capabilities subsequently improve service models or prompt new ones, such as emergency response, prediction of citizen's needs, and anticipation of citizen's problems.
Third-party service delivery	Citizens prefer a networked governance system where responsibilities are distributed among government and a variety of non-government actors. Enabling non-government actors as co-creators or co-producers of public services improves citizen's convenience and choice when accessing public services, and ultimately improves citizen's satisfaction.

4.3. United Nations METER 2

The main goal of METER 2 is to help decision-makers self-assess their organizational capabilities for the use of information technologies to provide public services [47]. METER 2 is conceptualized around the idea of transforming government, which refers to the transition toward better public service delivery and government-citizen interaction.

Dimensions. The UN METER 2 Model is composed by five dimensions: commitment, legal, vision and policy, organization, and technology. Commitment refers to the mobilization of resources to support a digital transformation strategy. Commitment refers to a managerial capacity to motivate public officers and build political will to set in motion the resources needed (i.e., human and financial resources, as well as infrastructure) towards a common organizational goal. Legal is the set of laws, rules, guidelines and standards that are relevant to the digital transformation strategy. The regulatory regime might be unfriendly to the desired organizational change, and therefore slow down the appropriation of IT. In contrast, a "friendly" regulatory regime, not only does not prevent organizational change, but its design prompts the behaviors desired from the people involved.

Vision and policy refer to strategic plan that links how the technological opportunities help governments to achieve their overall priorities. It is a plan that sets common goals and helps the members of the organization follow a plan to achieve them. The organizational view is assessed primarily on its capacity to break down the organizational silos for inter-organizational collaboration and sharing of information. Finally, technology is a dimension that describes the information technologies that help to create an interconnected government –among government agencies, and with citizens and businesses. Technologies also improve government responsiveness.

Table 6: Dimensions in UN METER 2 Model

Dimension	Description
Commitment	Mobilization of organizational resources for enabling a supportive environment for a digital transformation strategy.
Legal	Set of laws, rules, guidelines, and standards relevant to digital government activities. These could be existing or planned rules.
Vision & Policy	Statement that links how the technological opportunities help government achieve their overall priorities.
Organizational View	Describes the dominant model of public service delivery. The dominant model can be, for example, a networked governance or a traditional hierarchical organization.
Technology	Information technologies help to create a connected government, and improves government responsiveness.

Enablers. From this model, we identified five enablers: leadership, regulatory regime, institutional arrangements, networks of organizations, and access to information and communication technologies (ICT). Leadership focuses on the capacity of building commitment from public officers and political will from government's leaders. Commitment helps a digital transformation strategy advancing the organization's maturity level.

The regulatory regime is perceived as a constraint for technological changes. The perceived barriers are related to "archaic laws" or regulatory regimes having opposed goals than the ones set in the digital transformation strategy. The theory of change of the regulatory regime emphasizes that a revision and change of the regulatory regime leads to a "friendly" or supportive environment for advancing the organization's maturity level.

The institutional arrangements are processes that shape the interaction among public officers within the same organizations or among different organizations. Institutional arrangements help advance maturity levels when a specific organization or institution has been established as a focal point for planning, supporting, coordinating and overseeing the efforts from the relevant organization's departments and agencies.

Horizontal and vertical coherence among all government's departments and agencies provides the alignment of efforts around a digital transformation strategy and helps conciliating possible disagreements with among agencies or between government and citizens.

Finally, on the technological aspect, the advance towards desired stages of maturity requires that all parties involved (i.e. public officers and citizens) have access to reliable ICTs. Access refers to the physical access to the technological devices, and the skills required to use them.

Table 7: Enablers in UN METER 2 Model

Enabler	Theory of change
Leadership	Commitment from leaders guide the interweaving of strategic goals, resistance to IT changes, and programmatic actions necessary for organizational change.
Regulatory	Archaic laws, old regulatory regimes, and overlapping regulations complicate the adoption or use of new IT. IT-based regulatory reforms are normally a boost for a digital transformation.
Institutional Arrangements	An agency or institutional mechanism should serve as the focal point of planning, supporting, coordinating and overseeing the collective efforts from different departments and agencies.
Network of Organizations	Networked governance models improve citizen's satisfaction of public service delivery. A horizontally and vertically cohesive network of government organizations also improves public service delivery effectiveness.
Access to IT	Reliable access to IT infrastructure to public officers and citizens must be improved.

5. TOWARDS AN ENABLER-BASED FRAMEWORK

Based on the previous discussion and findings, we developed the Enabler-Based Digital Government Maturity Framework (EDGMF). This framework compiles and integrates the dimensions commonly found across the different cases analyzed as well as their theories of change. The EDGMF seeks to provide a road map for improving organizational capabilities to optimize the use of information technologies. We must emphasize that the dimensions referred below represent an initial effort and the framework is far from being conclusive. Our goal is to show an operational enabler-based model and, to do so, we present an illustration.

The EDGMF is composed of seven dimensions: (1) leadership, (2) regulatory regime, (3) strategy, (4) organization, (5) governance, (6) technology, and (7) data. Leadership refers to the level of commitment of the managers leading the digital transformation. These managers are usually at the executive office level and could include a (management-oriented) Chief Executive Officer, and a (technology-oriented) Chief Information Officer. Leaders must employ management skills to ease the tensions associated with technological and managerial changes. Leaders can also promote staff's engagement and informativeness to better accomplish the goals.

Regulatory regime is the set of rules that may promote or prevent the adoption and use of information technologies. Archaic laws, old regulatory regimes, and overlapping regulations complicate the adoption and use of new IT. Normally, the regulatory regime must be reviewed and revised to align the rules with the desired digital transformation.

Strategy refers to the planning that weaves and communicates the opportunities that emerging IT offer to address some of the overall government priorities. The strategy helps keeping focus, pace, and purpose on the organizational efforts to bring

organizational change. Strategies compile the assumptions and choices that governments make on how to pursue their goals.

Organizations with more readiness to work in collaboration are more likely to succeed in advancing maturity stages. A horizontally and cohesive network of government agencies improves effectiveness in public service delivery, and therefore improves citizen's satisfaction. Central to this dimension are all efforts to ease inter-organizational collaboration, such as meetings, joint planning, etc. A quest for collaboration, however, lessens the overall government capacities for decentralization and specialization [11, 12, 24]. This is not trivial, since government reforms worldwide during the last two decades have stressed these two organizing principles [20, 31, 40].

Governance as a dimension is related to organization, since it also explains the need for multiple agencies working in coordination. The organization dimension focuses on the capacities within agencies to ease collaboration. In contrast, the governance dimension looks at the overall structure of government to assess governance mechanisms. Governance mechanisms are important because they help different agencies to accomplish both common and agency-specific goals. Governance mechanisms also include non-government actors to improve the public service delivery, democratic governance, or decision-making.

Technologies are perceived as supporting elements of the broader digital strategies. Maturity is not only advanced by adopting new technology, but also by making sure it is reliable and available for all intended users. Reliability requires a human and physical infrastructure that will repair or replace damaged equipment, so the technology is running seamlessly. Availability requires access to technological devices and the development of skills in the users (public officers and citizens).

Data is a dimension that emphasizes the emerging possibilities regarding the rise of big data. More data not only means a bigger sample size or variables available, but also a broader variety of data structures (e.g., social network, geographic, text, sensor data). The traditional problem of limited information for decision-making can be lessened with more availability of, and access to and use of data. Also, complex problems, also referred to as wicked problems, can be better addressed or understood with the use of better data. Big data solutions, however, also requires new skills in both data management and use.

Table 8: Dimensions in EDGMF

Enabler	Theory of change
Leadership	Commitment from the manager to lead the digital transformation. Leaders must employ management skills to ease the tensions from technological or managerial changes.
Regulatory Regime	Regulations may undermine the development of digital government. The regulatory regime must be reformed to align rules with the desired digital transformations.
Strategy	Planning weaves and communicates the opportunities that emerging IT offer to address some overall government priorities.

Organization	Organizational models that ease inter-organizational collaboration will improve public service delivery and citizen's satisfaction.
Governance	By distributing responsibilities, among government and non-government actors, governance network mechanisms improve public service delivery, democratic governance, and decision-making.
Technology	Technological change must be done through a smooth transition. This transition must be accompanied with actions to develop necessary skills for users.
Data	Getting more data from multiple sources helps overcoming the problem of limited information and helps facing complex problems. Big data solutions also require a new set of skill data management and use.

6. IMPLICATIONS

After reviewing the literature and existing digital government maturity models, this article analysed three maturity models with rich descriptions of their dimensions and stages to explore their enablers. We found some common enablers among all cases, from which we developed the EDGMF. Each enabler presented in the EDGMF draws from a general theory of change to advance digital government initiatives. General theories of change, however, are insufficient unless accompanied by specific subordinate minor theories of change. We refer to these as sub-enablers. For example, the enabler 'leadership' is considered a key factor in the maturity models, but leadership alone, is a vague concept that could be operationalized in different ways. To make leadership an influential factor, action must be taken by the leaders on certain features that affect organizational change, such as creating vision [6, 16] or possessing motivation skills [25].

When screening the 27 maturity models that met the first inclusion criteria for the case selection, we observed that most of the models had a limited uni-dimensional description of the stages. Most of the maturity models, especially from journal articles, provide a brief overall snapshot for each stage. Such limited descriptions imply that limited attention was paid to the organizational dimensions while advancing maturation stages. As a result, these maturity models, although strong for diagnosing and setting goals, are weak for providing recommendations for organizational change.

A recurrent criticism of maturity models has been the lack of theory supporting the "evolutionary" path towards advanced levels of technology appropriation [13, 14, 23, 39]. Developing a maturity model entails a decision on whether to start by empirically observing emerging technologies or by systematically reviewing existing theories. Starting with emerging technologies promotes the rapid assimilation of promising new technologies for making operations more efficient or effective. Several authors have pointed, however, that technology-based models often become obsolete with the advent of newer technologies [7, 14, 21, 22, 39].

Starting with theory, on the other hand, has many advantages. For example, it reduces risk of failure on technology assimilation [2, 21, 39], allows models to be empirically tested [37], and helps build more accurate constructs around enablers and the areas of the organization relevant to the model [37]. Having good constructs also helps in building more reliable measurements [37].

Ultimately, this helps to ground recommendations on sound theory, which means to convincingly explain why digital government evolves the way it does. In addition, from a more practical perspective, enabler-based models can help decision makers to understand better which actions, resources and capabilities are more important to move from one stage to another.

The EDGMF's set of enablers and theories of change are not always grounded in sound theory. Some of them are based on what could be considered weak theories of change. The spirit of this proposal, however, is illustrative and we do not argue that this is a final product. Rather, we hope to start a conversation about mechanisms of action in the literature of digital government maturity models. We argue that this paper will help this conversation forward by providing a model that goes beyond current stage-based maturity models.

One explanation for why this and other, models are weakly grounded on theory is seemingly the lack of multidisciplinary research. The enablers are broad and complex constructs, and draw from so many diverse fields of study, that different types of expertise are needed while conceptualizing maturity models. For example, regulatory regimes require expertise on legal studies, while leadership and organization must draw from organizational theory, and management studies, respectively. Organizational theory, in particular, has been especially absent on the development of maturity models [34].

The stage and enabler-based approaches are both useful and complementary. Stage-based models are useful for comparisons, and provides a sense of position, progress and direction. Normative in nature, they have a prescription to follow. Enabler-based models inform what actions are required in which organizational areas, so a government can reach the progress and direction set in the stage-based model. An enabler-based approach helps to reduce failure in technology assimilation, as key factors are better understood. Enabler-based models provide prescriptions for action, based on explanatory information (e.g., how leadership works, and what is affected by leadership).

The enabler-based approach provides a second set of guiding principles for maturity model users to choose among the vast range of options. A strong maturity model must offer a stage path to follow. Also, a strong maturity model must make a case on why organizations should follow that path and provide strong recommendations for achieving different levels of maturation. It should clearly explain how and why different dimensions of digital government will evolve. The theories of change should also be connected to overall government goals, such as improving citizen trust in government, citizen satisfaction, and service quality. To do so, a strong maturity model should be blended with design science and social sciences, as some scholars have suggested recently [10, 14, 30, 34]. Design science helps to imagine what is possible, what possibly adds value, but not yet empirically observed or validated. Social sciences provide stable models of behaviour, across time and space, which help in understanding government organizations and individual stakeholders.

7. CONCLUSIONS

In recent decades, literature on digital government maturity models has focused on conceptualizing stages. As a result, current knowledge about stages of technology maturation is well developed. Such knowledge is useful in identifying the current state of affairs in terms of digital government and envisioning a desired alternative scenario. Identifying and understanding the mechanisms underlying potential recommendations for action, however, have been largely overlooked. In this regard, a broad base of literature from multiple disciplines and fields of knowledge has great potential for strengthening digital government maturity models. A greater focus on the mechanisms by which certain resources and capabilities help an organization to advance to the next stage of maturity would lead not only to more detailed understanding of those mechanisms and their interdependence, but also to solid recommendations for action.

In an attempt to better understand the enabling mechanisms of digital government maturity, this article presents an Enabler-Based Digital Government Maturity Framework. This is yet another, and limited, maturity model, but it adds value in its focus on enablers rather than stages. As noted, the main benefit of this approach is to allow for more accurate and specific recommendations based on the diagnostic assessment provided by the same model. We argue that stage and enabler-based approaches are complementary tools, while stage models set the diagnosis and the path to follow, enabler-based models provide insights on how to get there. After considering dozens of maturity models, we believe that these two parameters could be seen as the key to helping decision makers and researchers know which ones are strong models, with the greatest value to theory and practice. Finally, we believe an enabler-based approach could help to develop better recommendations for action and improve the overall utility of digital government maturity models.

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