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Digital Government Evolution: from Transformation to Contextualization

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Abstract: The Digital Government landscape is continuously changing to reflect how governments are trying to find innovative digital solutions to social, economic, political and other pressures, and how they transform themselves in the process. Understanding and predicting such changes is important for policymakers, government executives, researchers and all those who prepare, make, implement or evaluate Digital Government decisions. This article argues that the concept of Digital Government evolves towards more complexity and greater contextualization and specialization, similar to evolution-like processes that lead to changes in cultures and societies. To this end, the article presents a four-stage Digital Government Evolution Model comprising Digitization (Technology in Government), Transformation (Electronic Government), Engagement (Electronic Governance) and Contextualization (Policy-Driven Electronic Governance) stages; provides some evidence in support of this model drawing upon the study of the Digital Government literature published in Government Information Quarterly between 1992 and 2014; and presents a Digital Government Stage Analysis Framework to explain the evolution. As the article consolidates a representative body of the Digital Government literature, it could be also used for defining and integrating future research in the area.

Keywords: Digital Technology; Digital Government; Digital Government Evolution; Digital Government Innovation; Digital Government Institutionalization; Digital Government Research

Highlights:

- Digital Government evolves through Digitization, Transformation, Engagement and Contextualization stages.
- Each stage has a logical description based on three binary variables and a thematic description based on related literature.
- Each stage can be explained by pressures on government and how digital innovation is applied to address such pressures.

- The model was validated by analysis of Digital Government articles published in GIQ between 1992 and 2014.
- The fastest growth is observed in the Engagement stage, followed by Contextualization, followed by Transformation.

1. Introduction

An increasing share of cultural, political, economic and other human activities taking place in the digital space risk amplifying existing problems of division, inequity, exclusion, fraud, insecurity, imbalance of power, and many others. For example: 3 billion people are using the Internet, but 90 percent of the rest live in the developing world (ITU, 2014); digital natives make 30 percent of the youth population (ITU, 2013) but less than one in four young citizens are voting (Pilkington, 2014); Facebook has 1.44 billion and YouTube 1 billion active users (The Social Media Hat, 2015), but 12 percent of social media users report that someone has hacked into their social network accounts and pretended to be them (Symantec, 2014); smart phone users spend 89 percent of their mobile media time interacting with apps (Nielsen, 2014) but 48 percent of them would limit their use of apps unless their personal information was better safeguarded (GSMA, 2014); Google holds 68 percent of the U.S. online search market (Zeckman, 2014) and Alibaba holds 80 per cent of the e-commerce market in China (Lee, 2014), far ahead of their nearest competitors; etc.

While it is clear that governments and policy-makers cannot leave the digital space unattended or ungoverned, a question is how exactly should the core government functions – providing public services and infrastructure, formulating and implementing public policies, maintaining social order and security, operating social programs, promoting economic growth, etc. be performed in both physical and digital worlds. The answer partly lies in existing government digitization initiatives that take place around the world and the experience and lessons learnt from them, and partly in research and reflection on such experience. However, with no universal model existing to inform government digitization efforts in different national, local and sectorial contexts, progress can be only achieved through the simultaneous pursuit of multidisciplinary research, which itself is rooted in the administrative, economic, engineering, legal, social, and other disciplines, policy and practice. This interaction between practice and research gives direction and progress to what we call Digital Government.

This paper tracks the evolution of the Digital Government concept considering three questions:

1. How did the interest in the Digital Government concept evolve over the years?
2. What evidence exists in support of the Digital Government evolution?
3. How to explain and interpret the Digital Government evolution?

Concerning the first question, following (Janowski, 2015), we propose a Digital Government Evolution Model with four increasingly complex phases in the evolution of the concept: Digitization (Technology in Government), Transformation (Electronic Government), Engagement (Electronic Governance) and Contextualization (Policy-Driven Electronic Governance). The model also offers a characterization of the phases depending upon three binary variables: 1) whether

digitization adds to internal working and structures of government but largely without affecting them, or it transforms the internal working and structures of government; 2) whether the transformation is internal to government but not affecting its customers, or it transforms the internal working and structure of government as well as its relationships with citizens, businesses and other stakeholders; and 3) whether the transformation depends on a particular application context, e.g. of a country, location or sector, or is context-independent. For example, all three variables are negative for the Digitization phase, all three are positive for the Contextualization phase, and some of the variables are positive and others negative for the remaining phases. The model is depicted in Figure 1, partly adapted after (Janowski, 2015).

STAGE	APPLICATION CONTEXT	CHARACTERIZATION		
		Internal government transformation	Transformation affects external relationships	Transformation is context-specific
Digitization	Technology in government	no	no	no
Transformation	Technology impacting government organization	yes	no	no
Engagement	Technology impacting government stakeholders	yes	yes	no
Contextualization	Technology impacting sectors and communities	yes	yes	yes

Figure 1: Digital Government Evolution Model

Concerning the second question, the paper presents some evidence in support of the model based upon year-by-year study of selected research literature, particularly 292 relevant research articles published in Government Information Quarterly between 1992 and 2015 and how their focus on Digital Government have evolved over the years.

Concerning the third question, the paper proposes a Digital Government Stage Analysis Framework that examines various social, economic, political and other factors that put pressure on governments; governments adopting the latest in mobile, cloud, social, virtual and other technologies available at the time and innovating with the use of such technologies to respond to the current pressures; and new paradigms of technology-enabled public governance emerging through the repeated process of technology-enabled innovation. We also examine how the framework explains the four evolutionary stages of Digital Government.

The rest of this paper is structured as follows. Section 2 presents research methodology. According to the methodology, related work is described in Section 3, characteristic variables underpinning the Digital Government Evolution Model are described in Section 4, and the model is presented in Section 5. Section 6 offers some evidence in support of this model based on selected research literature, while Section 7 presents and applies the Digital Government Stage

Analysis Framework to explain the origins, mechanisms and consequences of the four evolution stages. The final Section 8 offers some conclusions.

2. Research Methodology

The research methodology is depicted in Figure 2 and described below.

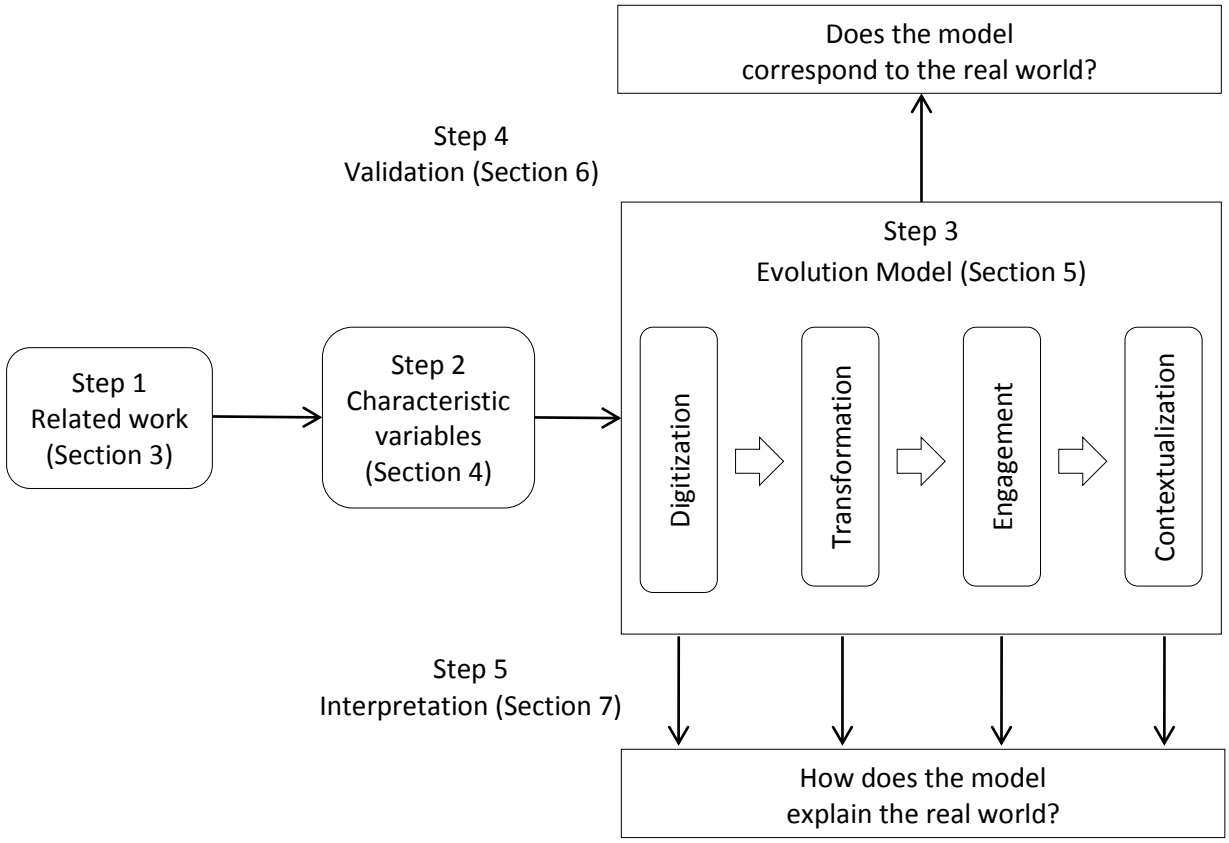


Figure 2: Research Methodology for Digital Government Evolution

Step 1 in the methodology aims at identifying related work. It involves conducting a systematic search on Scopus – the largest abstract and citation database of peer-reviewed literature (Elsevier, 2015), of the research literature on the topic of Digital Government Evolution. The outcome of this step is described in Section 3.

Step 2 in the methodology aims at defining a set of characteristic variables to identify and formalize different aspects of the Digital Government Evolution. Each variable is expressed as a binary true/false question to ensure objectivity and focus of the analyzed aspects of the evolution, and its validity is supported by a number of references to previous research literature identified in Step 1. The outcome is described in Section 4.

Step 3 aims at constructing the Digital Government Evolution Model. The model is obtained by logical construction from the set of characteristic variables defined in Step 2: each stage of the model corresponds to one permutation of the values of the variables, determining the presence or absence of characteristic features at this stage. The outcome is described in Section 5.

Step 4 aims at validating the Digital Government Evolution Model, obtained by logical construction in Step 3, based on 292 articles published about Digital Government in Government Information Quarterly between 2000 and 2015. The outcome is described in Section 6. Government Information Quarterly was selected as the source of research evidence due to its status as the leading journal in the area (Scholl & Dwivedi, 2014).

Step 5 aims at interpreting and explaining Digital Government Evolution through the lenses of the Digital Government Evolution Model – what are the reasons and consequences of different stages according to the Digital Government Stage Analysis Framework provided by the paper. For different stages, the framework identifies various social, economic, political, ecological and other pressures on governments, how government respond to such pressures by innovating around existing technological trends, and how such innovations result in new forms of technology-enabled public governance. The outcome is described in Section 7.

3. Related Work

According to the research methodology depicted in Figure 2, Step 1 involves a systematic search of the research literature on the topic of Digital Government Evolution. Conducted on Scopus, the search identified relevant articles by the presence of “evolution” and one of "e-government", "e-governance”, "electronic government", "electronic governance" or "digital government" among their titles, abstracts and keywords.

The search produced 316 articles published between 1992 and 2015, the peak year being 2011 (59 publications), followed by 2009 (33 publications) and 2012 (32 publications), and with 21 articles published annually on average since 2013. The number includes 160 conference papers (51 percent), 85 journal articles (27 percent) and 25 book chapters (8 percent). The largest contributors among journals being “Government Information Quarterly” (Elsevier) with 9 published articles, followed by “Electronic Government” (Inderscience) with 7 published articles and “Transforming Government: People, Process and Policy” (Emerald) with 4 articles. The review of the list produced 24 related publications, which are referred later in this section to describe the state of the art in Digital Government Evolution.

The evolution of Electronic Government is subject to emerging but regular patterns of growth, influenced by the larger social, economic and political environment, and possibly incremental progress: Based on the analysis focused on structuring through services and structuring through technology, (Meneklis & Douligeris, 2007) points out that the evolution of Electronic Government is subject to patterns that affect the process in deep, subconscious and recursive ways, which patterns could be used to enhance modelling methodologies for related information systems. (Bicking, Janssen, & Wimmer, 2006) presents the results of a scenario-building exercise for

Electronic Government in 2020 and beyond as part of the EC-funded eGovRTD2020 project, and describes the first set of four scenarios that are differentiated by different aspects of integration, centralization versus decentralization of power and related government structures, and democratization and the role of individualism versus collectivism in the society. After conducting the study of official city websites in several cities in Romania, considering public service provision and citizen participation, (Stoica & Ilas, 2009) concludes that the evolution of urban Electronic Government in Romania and the reform of traditional public administration is not a transformational process but a step-by-step incremental process.

Electronic Government evolves towards more complexity: The evolution of Electronic Government towards more transactional and integrated presence of government on the Internet, and the increase in technological and organizational sophistication taking place on the national and increasingly local level are two important dynamics of the evolution of Electronic Government according to (Gil-Garcia & Martinez-Moyano, 2007). (Katsonis & Botros, 2015) tracks the evolution of Digital Government from Electronic Government in the 1990s, through Government 2.0 in the 2000s, to today's digital by default agenda, and points out that along with the progress, the governance, cultural and leadership challenges deepened as well. (Luna-Reyes & Gil-Garcia, 2014) offers a theory of the co-evolution of technology, organization networks and institutional arrangements to explain the process of government transformation, including internal transformation in government and the transformation of the relationships between government and other social and political actors, through the development of information and communication technologies in government.

Electronic Government evolves towards more specialization: Based on the stage of development analysis of Spanish municipalities' web pages, (García-Sánchez, Rodríguez-Domínguez, & Frias-Aceituno, 2013) points out that the diversity of developments routes demonstrates that Electronic Government is not theoretically adequate as an aggregate concept and should be instead studied through particular applications. Following the Electronic Government stage models study of over 300 government portals in India, (Tripathi & Gupta, 2014) highlight that many portals do not follow such models and achieve the integration stage before the transaction stage, and that fundamental differences in social and political factors in different countries demand customized local models. Observing inconsistencies between models of Electronic Government development and Electronic Government evolution around the world, (J. Chen, Yan, & Mingins, 2011) proposes a three-dimensional model of Electronic Government development comprising the stage, functionality and effectiveness dimensions of Electronic Government.

Electronic Government evolves from addressing internal government concerns, including technological and operational issues, to external concerns, including institutional and political issues: (Jun & Weare, 2010) examines institutional motivations for adopting innovations, such as Electronic Governance, considering internal efficiency, internal politics and external demands, and finds out that external factors are more influential than internal ones, suggesting that the evolution of Electronic Government may make governments more responsive to external constituencies if barriers to change can be overcome. (Savoldelli, Codagnone, & Misuraca, 2014) examines the paradox of low Electronic Government adoption despite two decades of

investment, finds out that Electronic Government development was for a long time focused on technological and operational matters and only recently switched to institutional and political issues, which constitute the main barriers to adoption. Following a critique of the technology enactment framework for not showing how Electronic Government can evolve towards better democratic governance, (K. Yang, 2003) promotes a balance between agent and institution, and between strategic choice and institutional constraint in analyzing the evolution of Electronic Government as a long-term institutional change.

Electronic Government should to a larger extent support policy-making and regulatory functions of government, and not only administrative functions, and ultimately aim at addressing conditions of human life: (Rossel & Finger, 2007) see the need for continuous co-evolution between technological innovation and institutional transformation through collective problem-solving dynamics involving different types of stakeholders, which highlights that Electronic Government should contribute more to policy-making and regulation, and not only administrative services. Based on the study of the effectiveness of Electronic Government services in terms of their contribution to human life, (Çelik & Kabakuş, 2015) postulate that the evolution stages of Electronic Government services should aim at capturing citizen satisfaction.

Specific new phases of the evolution of Electronic Government include Transformational, Mobile, and Open Government: Concerning Transformational Government, (Parisopoulos, Tambouris, & Tarabanis, 2014) examines this concept, characterized by the radical restructuring of the public sector towards efficiency, assesses the level of sophistication towards this stage across member states in the European Union, and concludes that most countries only partly fulfill the full potential of Transformational Government; while (King & Cotterill, 2007) explores the potential of co-production as a candidate stage in the evolution of citizen-centric local public services. Concerning Mobile Government, (Misuraca, 2009) discusses some cases, risks and questions related to the development of Mobile Government as an emerging phenomena that may follow the first (EGOV 1.0) and second (EGOV 2.0) generations of Electronic Government initiatives, and raises some questions about adaptive or evolutionary nature of the change; while (Almunawar, Low Kim Cheng, Habibur Rahman, & Mohiddin, 2012) examines the impact of mobile technology on transition from Electronic Government to Electronic Governance, and how the latter can be applied to build people's trust, and proposes a trust model for Electronic Governance. Concerning the evolution from Electronic Government to Open Government, (Ruesch, Basedow, & Korte, 2012) introduces the concept of open participation, and provides three dimensions of openness – transparency, inclusiveness and receptiveness – for successful e-participation projects.

Electronic Government evolution paths differ between and within countries: (Dawes, 2008) examines the evolution of Electronic Governance, particularly in the US states and in local governments in the US in terms of policy framework, public service delivery, government operations, citizen engagement, and administrative reform; and observes that the greatest progress has been achieved in the areas of public service delivery and internal government operations, and the least in citizen engagement and administrative reform. Based upon content analysis of local government websites in several EU member states, (Pina, Torres, & Royo, 2009) found out the evolution of local Electronic Government towards increasing concern for bringing

citizens closer to government and creating an image of modernity and responsiveness, while following public administration styles of each country.

The measurement of Electronic Government must take into account the evolutionary nature of the concept, but lagging behind the evolution, measurement tools risk providing inaccurate assessments: According to (Dilip Potnis & Pardo, 2011), the United Nations e-Readiness surveys, a widely used point of reference for government officials and policy makers around the world have been evolving from the view of member states' governments acting as controllers of information to facilitators of information, highlighting the evolutionary character of the surveys. After reviewing Electronic Government benchmarking tools and practices, (Batlle-Montserrat, Abadal, & Blat, 2011) points out that Electronic Administration is the most benchmarked area, and that the tools' use of the models of Electronic Government evolution does not reflect new trends in the provision of public services, particularly on the local level. According to (Park, Choi, & Bok, 2013), accessibility should not be considered as the key factor in evaluating Electronic Government websites concerning their usage, and traditional supply-side evaluation may provide misleading information on Electronic Government evolution.

4. Characteristic Variables for Digital Government Evolution

Step 2 in the research methodology involves defining characteristic variables to capture different aspects of the Digital Government Evolution. Each variable is expressed as a binary true/false question, and supported by references to related work from Section 3.

The first major factor in defining Digital Government Evolution is the presence of transformation in government to accompany the process of digitization. A number of authors favor the transformational perspective. Transformational Government as a radical restructuring of the public sector and to what extent this concept is fulfilled across member states in the European Union are examined in (Parisopoulos et al., 2014). Transformation is reflected among four scenarios for Electronic Government in 2020, particularly centralization versus decentralization of power and related government structures (Bicking et al., 2006). A distinction between Electronic Government as a transformational process versus an incremental step-by-step process is made in (Stoica & Ilas, 2009). Likewise, (Rossel & Finger, 2007) makes a distinction between technological innovation and institutional transformation. Internal government transformation through the development of digital technologies in government is explained by co-evolution of technology, organization networks and institutional arrangements (Luna-Reyes & Gil-Garcia, 2014). Internal motivations for adopting innovation in government organizations, such as internal efficiency and internal politics, suggest internal transformational impact of such innovations (Jun & Weare, 2010). *In conclusion, the first characteristic variable for Digital Government Evolution is whether digitization transforms the internal working and structures of government (yes) or it adds to the internal working and structures but without affecting them (no).*

Assuming the presence of transformation to accompany the process of digitization in government, i.e. the positive value of the first characteristic variable, the second major factor in defining Digital Government Evolution is whether the transformation is internal to government

or it also transforms the relationships between government and its customers. A number of authors favor the latter perspective. Transformation of the relationships between government and other social and political actors and its explanation by the co-evolution theory are offered by (Luna-Reyes & Gil-Garcia, 2014). A shift towards Digital Government as a tool for increasing democratization is captured in one of the scenario-building dimensions for Electronic Government in 2020 (Bicking et al., 2006) and a similar shift towards citizen satisfaction is captured in (Çelik & Kabakuş, 2015). A distinction between internal and external motivations for adopting innovations in government, with emphasis on the latter is expressed in (Jun & Weare, 2010). Bringing citizens closer to government (Pina et al., 2009), citizen engagement (Dawes, 2008), diagnosing low adoption of Digital Government (Savoldelli et al., 2014), exploring the potential of co-production as a candidate stage in the evolution of citizen-centric local public services (King & Cotterill, 2007), exploring Government 2.0 as an interactive version of Digital Government (Katsonis & Botros, 2015), transformation towards Open Government (Ruesch et al., 2012) and building trust through the use of mobile technology in government (Almunawar et al., 2012) all reflect a shift from internal to external transformation. *In conclusion, the second characteristic variable for Digital Government Evolution is whether the transformation affects the relationships between government and its customers (yes) or is internal to government without affecting its customers (no).*

Under the same assumption about transformation accompanying the process of digitization, the third major factor in defining Digital Government Evolution is whether the transformation depends on the application context, of a country, city, sector, etc. A few authors point out the need for contextualization. Informed by the diversity of possible development routes, (García-Sánchez et al., 2013) propose that Electronic Government is studied through particular applications. (Tripathi & Gupta, 2014) makes a quest for local models to capture fundamental differences in social and political factors in different countries. In view of existing inconsistencies between models of Electronic Government development and Electronic Government evolution, (J. Chen et al., 2011) propose to capture stage, functionality and effectiveness dimensions of Electronic Government. A quest for Digital Government evolving towards more policy-level and regulatory contributions, while engaging different stakeholders, is made by (Rossel & Finger, 2007). *In conclusion, the third characteristic variable for Digital Government Evolution is whether the transformation depends on a particular application context, e.g. of a country, location or sector (yes), or it is applied without reference to any context (no).*

Table 1 provides the summary of all three characteristic variables.

NO	VARIABLE	EXPLANATION
1	Internal government transformation	Whether digitization transforms the internal working and structures of government (yes) or it adds to the internal working and structures but without affecting them (no)
2	Transformation affects external relationships	Whether the transformation affects the relationships between government and its customers (yes) or is internal to government without affecting its customers (no)

3	Transformation is context-specific	Whether the transformation depends on a particular application context, e.g. of a country, location or sector (yes), or it is applied without reference to any context (no)

Table 1: Characteristic Variables for Digital Government Evolution

5. Digital Government Evolution Model

Step 3 in the research methodology involves construction of the Digital Government Evolution Model based on three characteristic variables for Digital Government Evolution described in Section 4. This section describes the logical construction of this model in Section 5.1 and each stage in the evolution in Section 5.2.

5.1. Logical Construction of the Digital Government Evolution Model

Each stage of the model corresponds to one permutation of the values assigned to the characteristic variables described in Section 4 and summarized in Figure 2.

However, not every permutation of the variables corresponds to a valid stage in the model. First, the presence of internal government transformation, i.e. the positive answer to the "Internal transformation of government" variable, is conditional on providing positive answers to the remaining two variables that depend on the presence of internal government transformation. In particular, if the answer to the "Internal transformation of government" variable is negative, then the answers to the remaining two variables must be negative as well. Second, the transformation affecting external relationships, i.e. a positive answer to the "Transformation is context-specific" variable is conditional on the positive answer to the variable "Transformation affects external relationships" as the former depends on the possibility of transforming external relationships. In particular, if the answer to the "Transformation affects external relationships" variable is negative then "Transformation is context-specific" must be negative as well.

Under these two limitations, four possible permutations of the characteristic variables give rise to four corresponding stages in Digital Government Evolution:

1. Stage 1 – Digitization or "Technology in Government" features no internal government transformation and therefore no transformation of external relationships and no dependence on the application context.
2. Stage 2 – Transformation or "Electronic Government" features internal government transformation but no transformation of external relationships and therefore no dependence on the application context.
3. Stage 3 – Engagement or "Electronic Governance" features both internal government transformation and transformation of external relationships but no dependence on the application context.

4. Stage 4 – Contextualization or “Policy-Driven Electronic Governance” features both internal government transformation and transformation of external relationships and depends on the application context.

The four evolution stages and their characterization based on the three variables are depicted in Table 2, adapted after (Janowski, 2015).

NO	STAGE	VARIABLES		
		Internal government transformation	Transformation affects external relationships	Transformation is context-specific
1	Digitization (Technology in Government)	no	no	no
2	Transformation (Electronic Government)	yes	no	no
3	Engagement (Electronic Governance)	yes	yes	no
4	Contextualization (Policy-Driven Electronic Governance)	yes	yes	yes

Table 2: Digital Government Evolution Model

5.2. Digital Government Evolution Stages

This section provides the details of the four Digital Government Evolution stages constructed in Section 5.1 and summarized in Figure 3, including logical and practical consequences of the characterization of every stage, types of initiatives typical for the stage illustrated by references to the Digital Government literature, and the limitations of the stage and how removing such limitations motivate progress to the next stage.

The pool of references to the Digital Government literature applied in this section was systematically constructed from the articles published in Government Information Quarterly (GIQ) on the topic of Digital Government: all GIQ articles that include "e-government", "e-governance”, "electronic government", "electronic governance" or "digital government" as part of their titles, abstracts or keywords. The search identified 292 articles published between 1992 (2 articles) and 2015 (10 articles), with the largest annual growth between 2008 (15 articles) and 2009 (39 articles), and the largest number published in 2014 (42 articles). Subsequently, the articles were classified according to the four evolution stages, and examples from every stages used as references later in this section.

The remainder of this section is organized into four subsections dedicated to different stages in the Digital Government Evolution: Section 5.2.1 to Digitization, Section 5.2.2 to Transformation, Section 5.2.3 to Engagement and Section 5.2.4 to Contextualization.

5.2.1. Stage 1 – Digitization or Technology in Government

Aimed primarily at modernization, and secondly at internal efficiency and access, the Digitization Stage involves the development, operation and maintenance of the technological environment, including the availability of technological capabilities, services and infrastructure within and between government organizations. Based on this environment, the Stage entails the representation of data, documents and other information in digital formats, when previously held by government organizations in physical or analog forms; making such information available to staff, partners and other stakeholders within and outside a government organization in digital formats, when previously available to the same stakeholders in physical and analog forms; automating existing processes, services and the entire offices based on digitized information and its exchange through digital networks; and making the services accessible to citizens in digitized format and through digital networks, when previously accessible in physical and analog forms.

Examples of initiatives and investigations undertaken at the Digitization Stage, with references to selected GIQ publications, are grouped into three categories and outlined below:

- *Access to government information in electronic formats*: dissemination through depository libraries (Dugan & Cheverie, 1992); and design and operation of electronic information access programs (Dawes, Pardo, & Cresswell, 2004).

- *Developing, analyzing and operating government websites*: evaluation of user-centered government websites (de Jong & Lentz, 2006); implementing cataloguing and transactions stages of government websites and unequal progress among government-to-citizen, government-to-business and government-to-government services (Reddick, 2004); securing the content of e-government portals against cyber intrusions (Halchin, 2004); and analysis of web vulnerabilities of government websites (Awoleye, Ojuloge, & Ilori, 2014).

- *Technological infrastructure for digital government*: the development of the next generation digital government infrastructure including technological, sharing and knowledge services (Janssen, Chun, & Gil-Garcia, 2009); the implementation of cloud computing architecture to support electronic government and electronic voting solutions (Zissis & Lekkas, 2011); the integration of smartphone applications into existing government services (Lorenzi, Vaidya, Chun, Shafiq, & Atluri, 2014) and building specific applications, e.g. a decision support system for analyzing and classifying anonymous crime reports (Ku & Leroy, 2014).

The Digitization Stage in principle does not involve redesigning, improving or any way changing existing processes, services or practices, but merely digitizing and automating what already exists and making the outcomes available to the same stakeholders and customers through digital networks. If a process or a work practice were ineffective prior to digitization, they will likely remain equally ineffective afterwards. As such, the Digitization Stage alone offers limited value to government organizations in terms of improving their internal operations, adapting to

changing operational conditions and social expectations, and delivering value to the public, but it is a necessary step to subsequent stages in Digital Government Evolution. In order to fulfill the potential of digitization in the public sector, the restriction on transforming the working and structure of government organizations along with the digitization process must be removed. This transformation is the essence of the second Digital Government Evolution stage.

5.2.2. Stage 2 – Transformation or Electronic Government

The Transformation Stage aims at improving internal processes, structures and working practices of a government organization through the application of digital technology. The improvement often takes place as part of a larger administrative and institutional reform in government, and aims at internal efficiency, effectiveness, rationalization, simplification and other reform-related goals. The reform includes but is not restricted to improvements pursued within a single organization – cooperation with other government organizations, even whole-of-government arrangements comprising entire sectors and levels of government, are pursued at this stage. The main mechanism to carry out such improvement is technological and organizational innovation, including a fundament rethink of what a technology-enabled government, organization or sector does or should do in digital terms and how to align its business and technological developments. The main enabler to carry out such improvement is the digital and technological environment, including related capabilities and structures, established as part of the Digitization Stage.

Examples of initiatives and investigations undertaken at the Transformation Stage, with references to selected GIQ articles, are grouped into four categories and outlined below:

- *Organizational change and change management*: interdependency of e-government development and organizational transformation in public sector organizations, and characteristics of organizational transformation (Nograšek & Vintar, 2014); differences between private and public sector business process reengineering including planning for radical improvement through incremental steps and high level of participation (Weerakkody, Janssen, & Dwivedi, 2011); and applying digital technology to support the operations of bureaucratic organizations through e-bureaucracy and functional simplification and closure (Cordella & Tempini, 2015).

- *Project, program and portfolio management*: the impact of politics, intuition and coincidence on decision-making in portfolio management of e-government projects, ahead of technical rationality, and adoption of suitable project practices by government organizations (Nielsen & Pedersen, 2014); application of network concepts like, e.g. the politics of partner selection, network goals, institutionalization processes and incentives to inform the design of e-government projects (Guha & Chakrabarti, 2014); and an innovation model for identifying organizational processes of resistance and support to e-government innovations (Ebbers & van Dijk, 2007).

- *Development according to stage of growth models*: a stage model to guide the progress of government towards joined-up structure, including the development of capabilities to

migrate from one stage to another (Klievink & Janssen, 2009); and state government transition from the organizational to enterprise approach to computing, and a series of associated strategic planning and alignment efforts (Sawyer, Hinnant, & Rizzuto, 2008).

- *Information sharing and collaboration*: inter-municipal collaboration to support e-government development (Ferro & Sorrentino, 2010); and sharing information across vertical and horizontal boundaries of government organizations and pursuing a balance between centralized and decentralized information sharing (T.-M. Yang, Pardo, & Wu, 2014).

The Transformation Stage is in principle internal to government organizations and how they interact with each other. Citizens, businesses and other external actors may experience improved government interactions due to internal changes, but the impact is indirect. This limitation misses not only the opportunity of integrating citizens and other non-government actors with new digital ways of working and transacting with government organizations, but fails to utilize new digital channels for engaging citizens with government decision-making processes, and therefore building trust between the governed and the governing, and for empowering citizens. To this end, the restriction on not transforming the internal working of government along digitization process must be removed, and include transforming relationships between government and non-government actors.

5.2.3. Stage 3 – Engagement or Electronic Governance

The Engagement Stage aims at transforming the relationships between government and citizens, businesses and other non-government actors using digital technologies. The transformation aims at increasing access, convenience and effectiveness of public service delivery systems, engaging citizens in political and civil affairs, developing knowledge-based society and economy, and pursuing other high-value public policy goals. The Engagement stage is also part of a larger trend towards implementing the Digital by Default and Open Government principles, the letter aimed at increasing the transparency and accountability of government operations and the operations of public service providers, and in turn building trust between citizens and institutions, and between the governed and the governing. Realizing the Engagement Stage builds on the capacity of government organizations, thanks to the Digitization and Transformation stages, to interact with external actors and with each other through digital channels, to establish their presence and operations on various digital platforms, to collaborate across organizational boundaries, and to demonstrate performance improvements in technology-enabled internal operations.

Examples of initiatives and investigations undertaken at the Engagement Stage, with references to selected GIQ articles, are grouped into four categories and outlined below:

- *Increasing adoption by citizens*: applying communication and marketing strategies to lead citizens to electronic channels and thus increase the usage of e-government services (Teerling & Pieterson, 2010); the impact of technology knowledge – knowledge about and ability to operate specific technologies – on citizen engagement and the use of e-

government services (Cegarra-Navarro, Garcia-Perez, & Moreno-Cegarra, 2014); and organizational and user barriers, including access, trust, control and privacy, to the implementation of personalized e-government services (Pieterson, Ebbers, & van Dijk, 2007).

- *Increasing participation and engagement*: citizen coproduction and a unified typology or existing coproduction models along the "citizen sourcing", "government as a platform" and "do-it-yourself government" categories (Linders, 2012); and applying electronic rulemaking and its ancillary activities from the early stages of legislative and policy-making processes to increase public interest, involvement and commitment (Carlitz & Gunn, 2002).

- *Transparency, accountability and open government*: regulatory framework related to public information management and its application to the use of social media by government agencies, including opportunities, challenges and the ways of overcoming them (John Carlo Bertot, Jaeger, & Hansen, 2012); examining the legal and regulatory basis for President Obama's Open Government Directive to "establish a system of transparency, public participation, and collaboration" (McDermott, 2010); and the use of digital technology by parliaments and their members to support accountability and greater engagement with citizens and their communities (Missingham, 2011).

- *Cultural changes and trust building*: verifying the ability of technology-enabled change to increase citizen trust and transform government (Bannister & Connolly, 2011); and the potential impact of e-government and social media use by government organizations on social and cultural attitudes towards transparency and openness (John C. Bertot, Jaeger, & Grimes, 2010).

The Engagement Stage pursues improvements in the relationships between government, including executive, legislative and judicial branches, and its constituencies, including citizens, businesses, civil society organizations and other non-state actors. However, improvements in the relationships between government and its constituencies do not automatically translate into improvement in conditions for these constituencies to develop themselves. As development takes place mostly on the local, community and individual levels and concerns sector-specific needs faced directly by citizens and communities, focus on the local and sectoral needs is required to achieve development impact. This focus defines the next stage in the Digital Government Evolution.

5.2.4. Stage 4 – Contextualization or Policy-Driven Electronic Governance

The Contextualization Stage aims at Digital Government supporting specific efforts by countries, regions, cities, communities and other territorial and social units to develop themselves, e.g. to pursue specific public policy and sustainable development objectives. While the stage constitutes a major step beyond digitizing government (Digitization Stage), improving the internal operations of government (Transformation Stage) and improving the relationships between government and

constituencies (Engagement Stage), it also builds on the earlier stages by putting their outcomes at the service of public policy and development. A major consequence of the development focus is specialization of Digital Government initiatives at this stage, including their objectives, design, operations and outcomes, to different local, sectorial and local-sectorial contexts. The combination of context-specificity and development objectives is the cornerstone of this stage.

Examples of initiatives and investigations undertaken at the Contextualization Stage, with references to selected GIQ articles, are grouped into six categories and outlined below:

- *Contextualizing Digital Government*: considering various institutional, cultural and administrative contexts for implementing e-government in Sub-Saharan Africa (Schuppan, 2009); cross-cultural difference between Kuwaiti and British users' perceptions of e-government website quality (Aladwani, 2013); degree of e-government readiness and level of democratization as the context for e-government initiatives (Nour, AbdelRahman, & Fadlalla, 2008); differentiating website designs for different regions and communication channels for citizens with different backgrounds (Hsieh, Huang, & Yen, 2013); relating national culture and e-government readiness (Khalil, 2011).

- *Digital Government in national contexts*: Bangladesh – the impact of e-government on public service delivery and corruption control in Bangladesh (Bhuiyan, 2011); China – analysis of the village informatization program for rural development in China (Xia, 2010); Saudi Arabia – determining the acceptability of e-government to citizens in Saudi Arabia (Hamner & Al-Qahtani, 2009); South Africa – proposing a multi-cultural approach, informed by national development priorities, for pursuing e-government development in South Africa (Mukabeta Maumbe, Owei, & Alexander, 2008); Sri Lanka – critical factors for evaluating the public value of e-government in Sri Lanka (Karunasena & Deng, 2012).

- *Digital Government in sectorial contexts*: agriculture – identifying appropriate and cost-effective mobile government services for the agricultural sector (Ntaliani, Costopoulou, & Karetsos, 2008); customs – the factors enabling or hindering the adoption of e-customs platforms (Urciuoli, Hintsa, & Ahokas, 2013); health care – the impact of social media use in Danish health care (Andersen, Medaglia, & Henriksen, 2012); insurance – implementation and impact of the Florida Public Hurricane Loss Model (S.-C. Chen et al., 2009); justice – worldwide experience, particularly risk factors, with the use of e-justice platforms (Rosa, Teixeira, & Sousa Pinto, 2013); taxation – investigation of the tax information system and its usage in Greece (Terpsiadou & Economides, 2009); and water – semantic integration of data sources for water quality monitoring across government (Z. Chen, Gangopadhyay, Holden, Karabatis, & McGuire, 2007)

- *From Digital Government to development*: Chinese e-government initiatives supporting economic development through increasingly transparent and decentralized public administration (Ma, Chung, & Thorson, 2005); lean and platform-based government for mobilizing stakeholders and stimulating innovation (Janssen & Estevez, 2013); utilizing Digital Government in support of sustainable development (Estevez & Janowski, 2013);

public value and socio-economic impact of technology adoption in the public sector (Cordella & Bonina, 2012).

- *Addressing policy-relevant problems*: development of anti-corruption systems in the Republic of Korea (Kim, Kim, & Lee, 2009); examining the capacity of Internet adoption for reducing corruption (Lio, Liu, & Ou, 2011); reducing administrative burden on businesses (Arendsen, Peters, ter Hedde, & van Dijk, 2014);

- *Addressing the needs of vulnerable groups*: accessibility of e-government websites to the disabled (Kuzma, 2010); Chinese migrant farm workers (Wang & Chen, 2012); mobile technology and governance mechanisms for meeting livelihood needs of women head porters in Ghana (Ojo, Janowski, & Awotwi, 2013); provincial e-government providing online information to women exposed to domestic violence (Wathen & McKeown, 2010); telecentres with embedded business-to-citizen and government-to-citizens services for rural poor in India (Naik, Joshi, & Basavaraj, 2012); the impact of automation on assistance delivery to low-income people (Wilson, 2014); the readiness of e-government research to address the needs of the ageing society (Niehaves, 2011).

As seen from these examples, the Contextualization Stage pursues Digital Government as a vehicle for social, economic, political, cultural, etc. development in line with the needs and aspirations of countries, regions, cities and other territorial units and their people. Unlike earlier stages of the Digital Government evolution, Contextualization defines its objectives far and beyond the needs of government itself. In the proposed evolution model, this stage is the highest in the hierarchy, and future research should focus on determining and overcoming its limitations.

5.3. Digital Government Evolution Stages

In addition to characteristic variables that logically defined and contrasted different stages in the Digital Government Evolution in Section 5.1, Section 5.2 provided the same stages with thematic descriptions using categories of initiatives and investigations undertaken at each stage, derived from selected research literature. Complementing Table 2 with values of characteristic variables for every stages, Table 3 summarizes characteristic themes for every stage. While every theme is elaborated and supported by the relevant research literature in Section 5.2, given the selective nature of the consulted research literature, the themes may not be complete.

STAGE	THEMES
Digitization (Technology in Government)	Access to government information in electronic formats
	Developing, analyzing and operating government websites
	Technological infrastructure for digital government
Transformation (Electronic Government)	Organizational change and change management
	Project, program and portfolio management
	Development according to stage of growth models
	Information sharing and collaboration

Engagement (Electronic Governance)	Increasing adoption by citizens
	Increasing participation and engagement
	Transparency, accountability and open government
	Cultural changes and trust building
Contextualization (Policy-Driven Electronic Governance)	Contextualizing Digital Government
	Digital Government in national contexts
	Digital Government in sectorial contexts
	From Digital Government to development
	Addressing policy-relevant problems
	Addressing the needs of vulnerable groups

Table 3: Digital Government Evolution Stages and Themes

6. Validating Digital Government Evolution Model

Step 4 in the research methodology involves presenting some evidence in support of the Digital Government Evolution model presented in Section 5. The evidence is based upon year-by-year study of 292 relevant research articles published in Government Information Quarterly between 1992 and 2014. The aim of this section is to present this evidence.

The search for research literature on Digital Government focused on Government Information Quarterly (GIQ) as the leading journal in the area (Scholl & Dwivedi, 2014) and identified all GIQ articles that contain "e-government", "e-governance", "electronic government", "electronic governance" or "digital government" among the articles' titles, abstracts and keywords. The search produced 303 GIQ articles published between 1992 and 2015. After removing one errata article and 10 articles published in the incomplete year 2015, 292 articles were analyzed.

Figure 3 shows the growth trend in terms of the number of DG versus non-DG articles published in GIQ, with 2 versus 32 articles (6 percent) published in 1992, growing to 21 versus 23 articles (48 percent) published in 2007, 39 versus 33 articles (54 percent) published in 2009, 35 versus 42 articles (45 percent) published in 2012, and 41 versus 37 articles (53 percent) published in 2014. As the figure shows, although DG and non-DG articles reached almost equal shares of the GIQ publication space since 2007, the trend favors the growth of the DG share against non-DG.

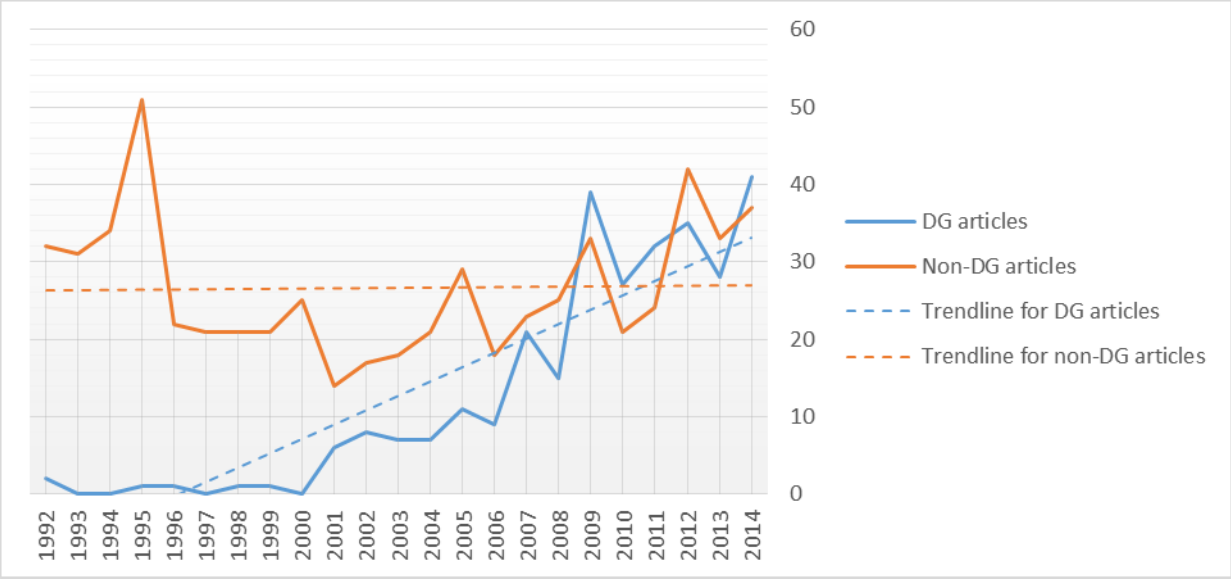


Figure 3: DG versus Non-DG Articles Published in GIQ

Figure 4 depicts the accumulated numbers of DG articles published per stage and outside any stage between 1992 until 2014. The Figure depicts the modest but sole presence of the Digitization Stage among the articles published between 1992 and 1994 (2 articles), the dominance of the Digitization Stage against the modest growth of the Transformation Stage between 1995 and 2000 (3 versus 2 articles), the fast growth of the Engagement Stage between 2002 and 2007 until it surpasses the Digitization Stage (21 versus 17 articles) and between 2008 and 2013 until it surpasses the Transformation Stage (79 versus 75 articles), and late and initially slow growth of the Contextualization Stage since the first article 2005 until the number of articles surpasses the number if non-stage articles in 2009 (13 versus 12) and closing on the number of Digitization Stage articles in 2014 (38 versus 44). In addition, the figure depicts the growth of the DG articles that do not belong to any stage since 1999 (1 article) until 2014 (29 articles). The figure provides some hard evidence in confirmation of the DG Evolution model in Section 5.

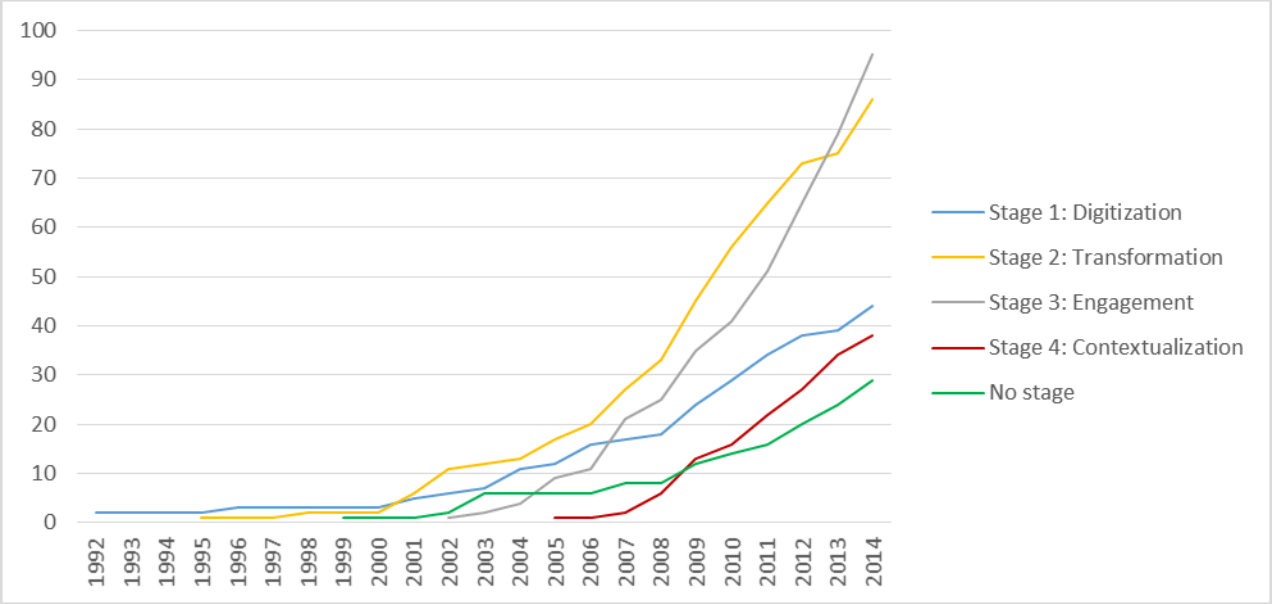


Figure 4: Accumulated Numbers of DG Articles Published in GIQ per Stage

Figure 5 depicts specific numbers of DG articles published per stage and outside any stage between 1992 and 2014, while Figure 6 depicts trend lines for different stages. The trend lines clearly depict the fast growth of the Engagement Stage, followed by the Contextualization Stage, followed by the Transformation Stage. The slowest growth can be observed in the no-stage category, followed by even slower growth in the Digitization Stage. The most revealing observation highlighted by this figure is the rate of growth in the number of DG articles at the Contextualization Stage, overtaking the Digitization and no-stage categories, and closing on the numbers of DG articles in the Transformation Stage.

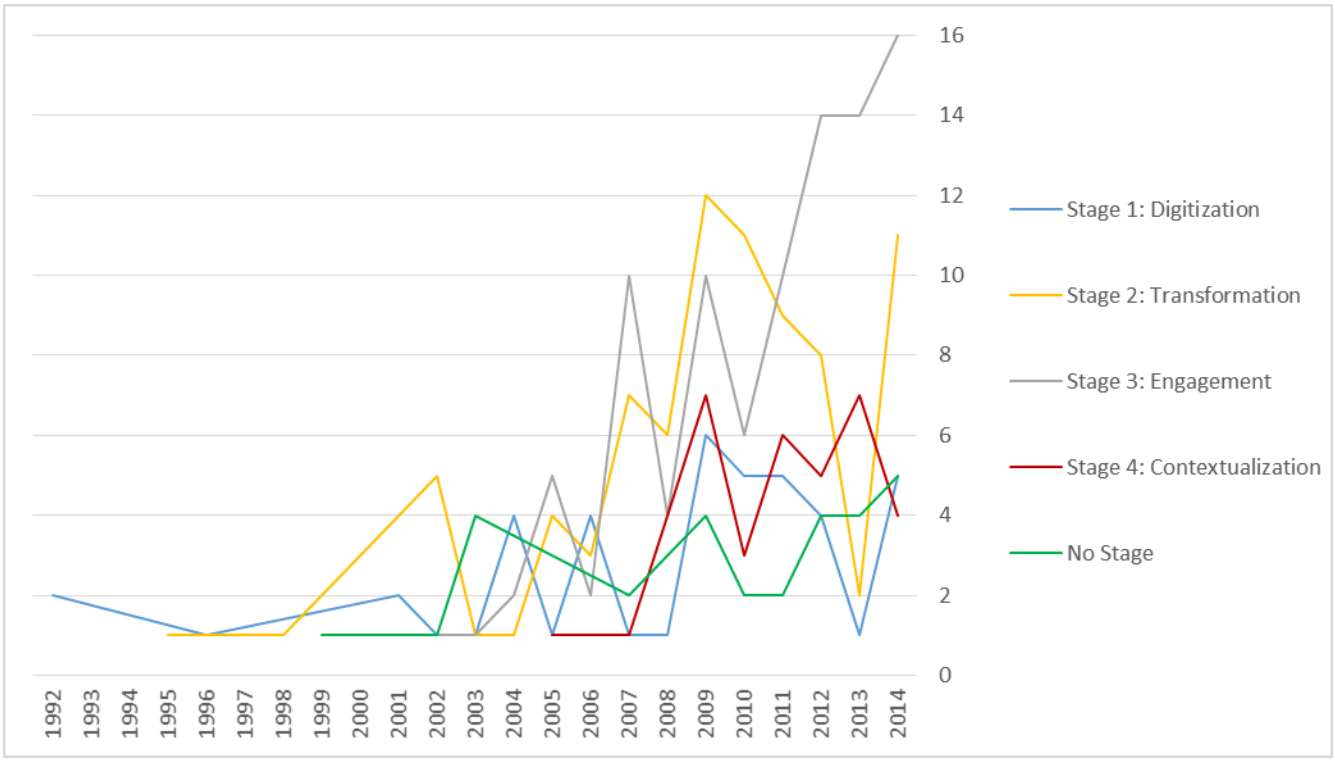


Figure 5: DG Evolution Stages Covered by DG Articles Published in GIQ, Annual Values

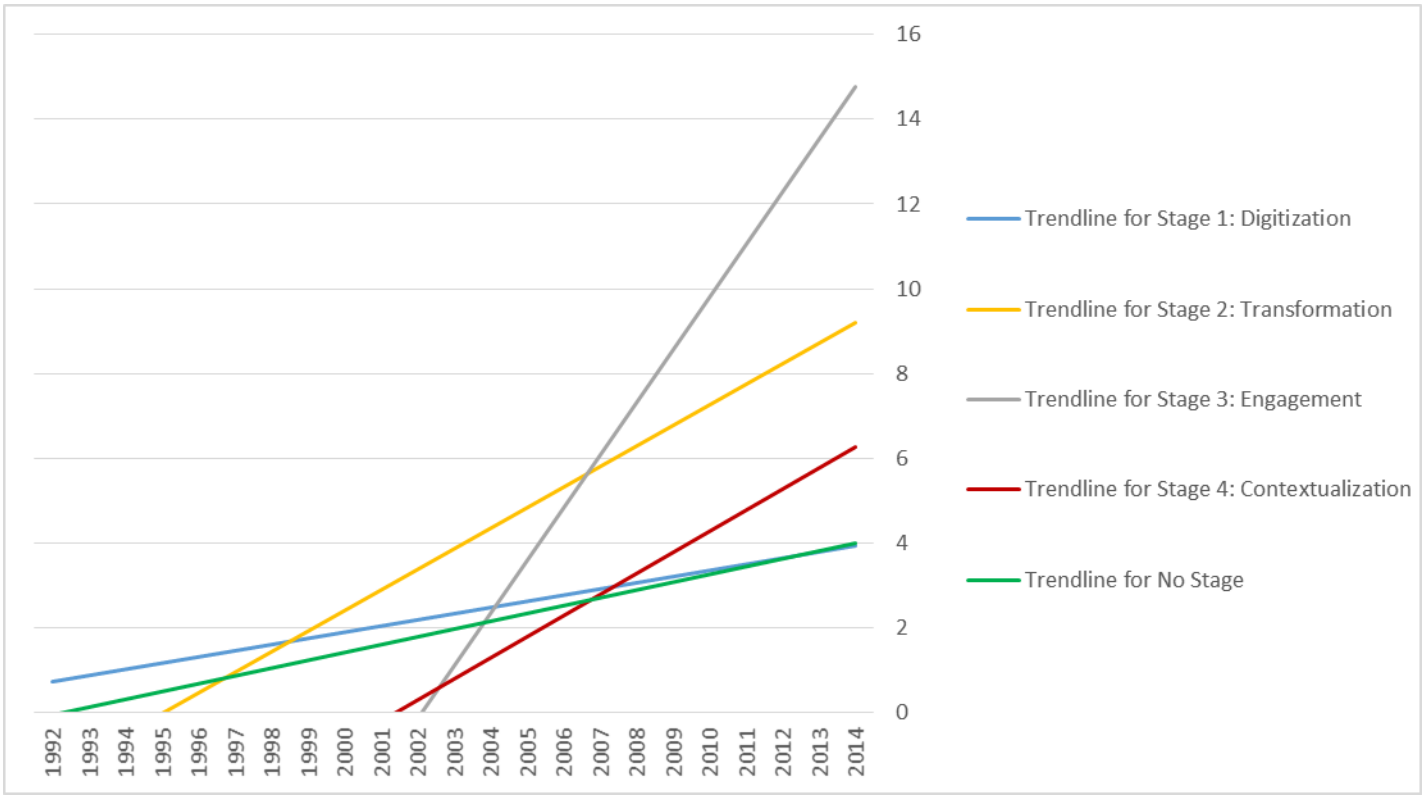


Figure 6: DG Evolution Stages Covered by DG Articles Published in GIQ, Trend Lines

Figure 7 depicts changing proportions between DG articles at different stages of the DG evolution published between 1992 and 2014. Again, the figure highlights the fast growth in the Engagement Stage, followed by the Transformation Stage, the ascendance of the Contextualization Stage, and relative decline of the numbers of articles published in the Digitization Stage.

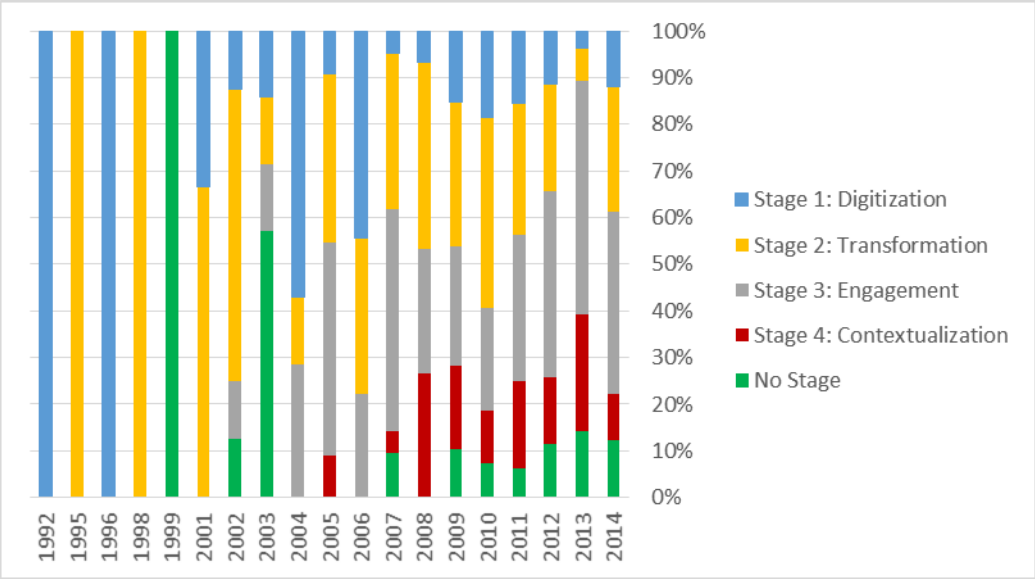


Figure 7: DG Evolution Stages Covered by DG Articles Published in GIQ, Annual Proportions

7. Explaining Digital Government Evolution

After defining and validating the Digital Government Evolution Model in Sections 5 and 6 respectively, this section aims at applying the model to interpret and explain the Digital Government Evolution, in particular by identifying and relating the origins, mechanisms and consequences of the four Digital Government Evolution stages. The explanations are provided through four instantiations of the Digital Government Stage Analysis Framework, introduced in Section 7.1, to different stages of the Digital Government Evolution presented in Section 7.2.

7.1. Digital Government Stage Analysis Framework

The framework anticipates that, at every stage in the evolution, governments organizations are under pressure from different sets of social, economic, political, ecological and other extraneous factors. In order to respond to such pressures, they adopt the latest in mobile, cloud, social, virtual and other Digital Technologies available at the time, and engage in various forms of Digital Government Innovation using such technologies. While initially such innovations provide just short-term responses to existing pressures, when applied, reapplied and improved over time, they become a prevailing practice embedded within government organizations, part of the

mainstreaming and institutionalization process that leads from Digital Government Innovation to Government Innovation. The Framework is depicted in Figure 8.

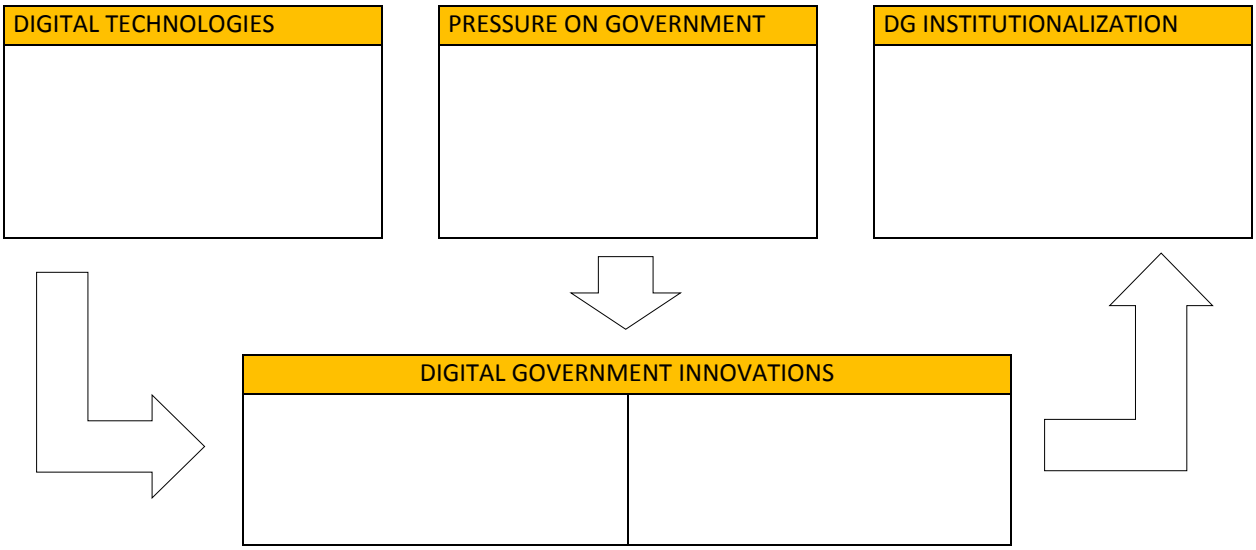


Figure 8: Digital Government Stage Analysis Framework

7.2. Explaining Digital Government Evolution Stages

This section presents four instances of the Digital Government Stage Analysis Framework, introduced in Section 7.1, one for each stage in the Digital Government Evolution. The instances are presented in subsequent sections: Digitization (Section 7.2.1), Transformation (Section 7.2.2), Engagement (Section 7.2.3) and Contextualization (Section 7.2.4).

7.2.1. Stage 1 – Digitization or Technology in Government

Some of the pressures on government that gave rise to the Digitization Stage include pressure to modernize and particularly bridge the public-private sector technology gap (White House, 2010), to increase internal efficiency, to enable greater and wider access to public information, to manage and preserve public records (Hughes, 2006), to build digital foundations of the society and economy, and many others.

At the same time, a whole range of digital technologies became available to potentially help address such pressures, from mainframe and personal computers, to office software, to local areas networks and the World Wide Web.

The key to realizing this potential – the ability to innovate with digital technologies – was realized through a range of technology-enabled innovations, most of them directly adopted after the private sector (Grudin, 1994), including: mass government data processing including procurement, payroll, taxation and statistics (OECD, 2003), electronic public records

management including health records, government management information and decision support systems, government information portals and electronic public services, computer-supported government work and government office automation, and many others.

In turn, these innovations were institutionalized and codified in government practice (Garson, 2006) through paperwork reduction, freedom of information and universal broadband and access laws, the development of the national cyber infrastructures underpinning information society and knowledge-based economy, etc.

Figure 9 depicts the Digital Government Stage Analysis Framework instantiated to the Digitization Stage.

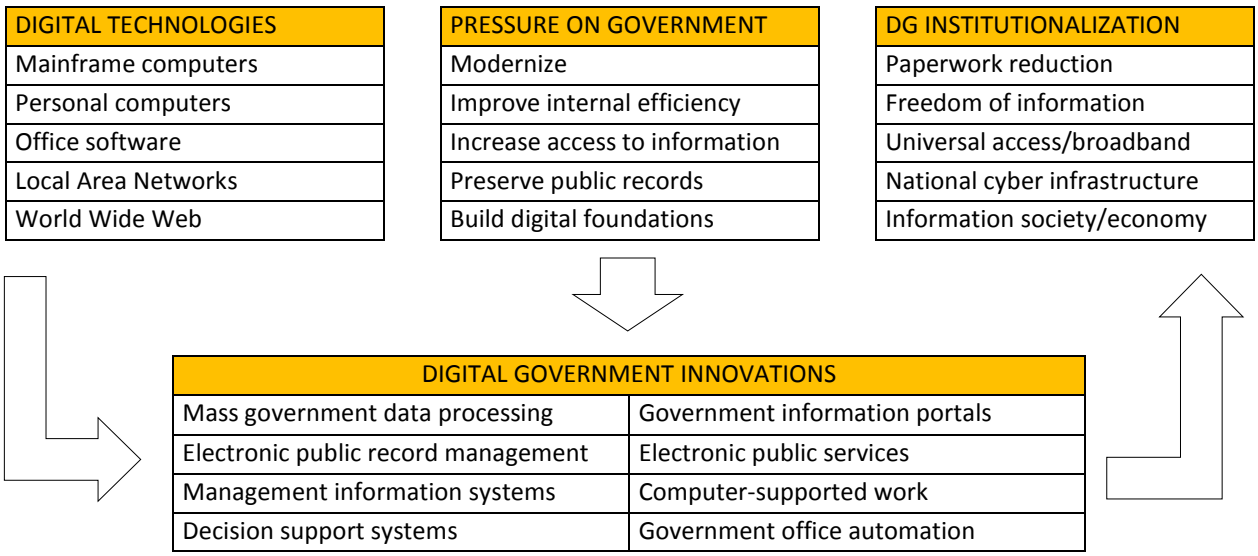


Figure 9: Instantiating Digital Government Stage Analysis Framework: Digitization Stage

7.2.2. Stage 2 – Transformation or Electronic Government

Some of the pressures on government that gave rise to the Transformation Stage include pressures to carry out institutional and administrative reform, to connect and integrate agencies, to deliver effective public services and government programs, to make smarter decisions, and many others.

At the same time, a range of digital technologies became available to potentially help address such pressures, from cloud computing, big data and analytics, to middleware software, workflow management software, and infrastructure, platform and software as service.

In order to realize this potential, various technology-enabled innovations emerged including: business process integration, business process reengineering, Public-Private Partnerships, electronic contracting, government information sharing, shared government services,

organizational interoperability, Government Chief Information Officer, government knowledge retention, government knowledge management, government change management, government performance management, government stakeholder management and government workforce management.

The institutionalization of the Digital Government innovations at the Transformation Stage leads to the emergence of some new governance paradigms, such as: Transformational Government, i.e. "ICT-enabled and organization-led transformation of government operations, internal and external processes and structures to enable the realization of services that meet public-sector objectives" (Weerakkody et al., 2011); Whole of Government, i.e. "public service agencies working across portfolio boundaries to achieve a shared goal and an integrated government response to particular issues" (Australian Public Service Commission, 2004); Lean Government, i.e. the application of lean management practices to the public sector aimed at actively identifying and eliminating the causes of organizational inefficiency and engaging in continuous improvement efforts (Gebre, Hallman, Minukas, & O'Brien, 2012); Data-Smart Government, i.e. government making intensive use of big data, predictive modeling and other forms of data analytics to focus on prevention rather than reaction, and to test policy options before implementation (Eggers & Macmillan, 2015); and some forms of Technocratic Government where decision-making by bureaucrats/experts is predominantly based on technological knowledge.

Figure 10 depicts the Digital Government Stage Analysis Framework instantiated to the Transformation Stage.

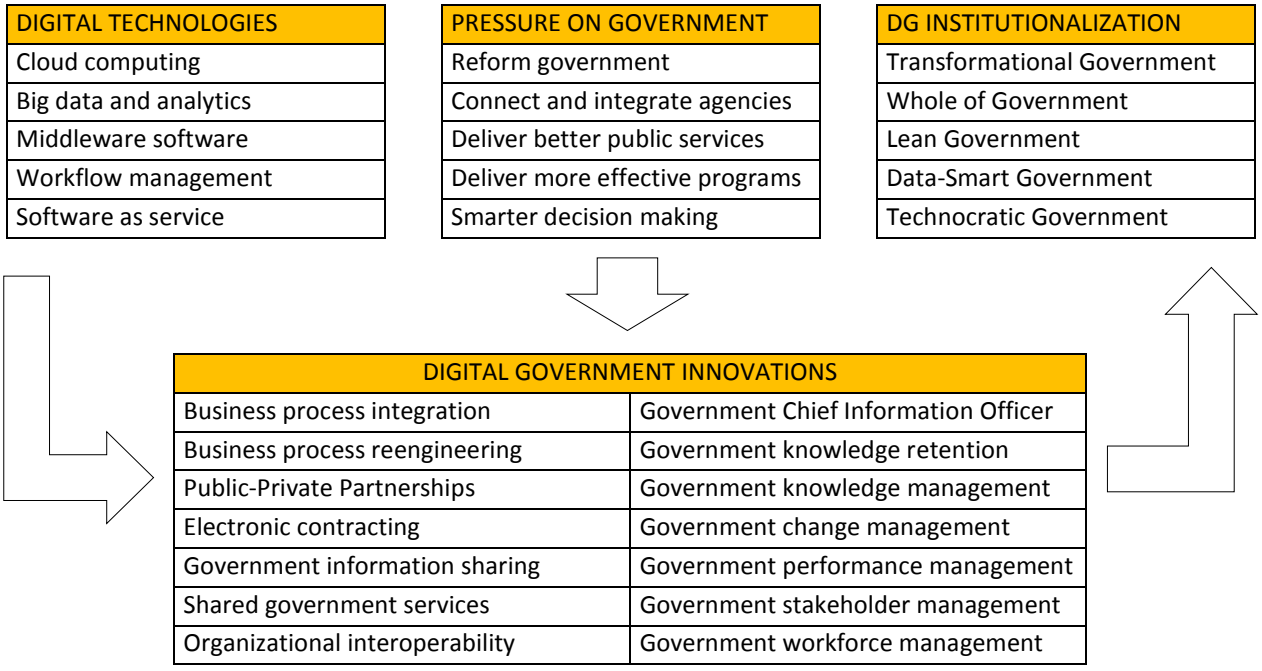


Figure 10: Instantiating Digital Government Stage Analysis Framework: Transformation Stage

7.2.3. Stage 3 – Engagement or Electronic Governance

Some of the pressures on government that gave rise to the Engagement Stage include: reaching out to unserved or under-served population, building situational awareness by directly consulting and engaging citizens, facilitating citizens to exercise their civil and political rights, engaging the private and voluntary sectors in delivering public services and running government programs, and facilitate growing demands for greater oversight by citizens and their representatives over government institutions and their decisions.

At the same time, a range of digital technologies became available to potentially help address such pressures. At the top of the list is social web and its many manifestations, such as: blogging and microblogging for online journal writing, tagging for assigning keywords to digital content, podcasting for publishing and using digital media, wikis for collaborative editing and content creation, social networking for connecting people and social bookmarking for managing bookmarks online. In addition: semantic web to assign semantic information to web resources, linked open data to publish structured and interlinked data in open formats; mashups to combine content from different sources; and sensor networks of spatially distributed autonomous sensors to monitor all operations of a city.

In order to realize this potential, various technology-enabled innovations emerged including: citizen consultation and ideation, crowdsourcing and co-delivery, electronic rule-making, social enterprise for public service, volunteering for public service, automated fraud detection, participatory budgeting, digital collaborative accountability, expose and investigate services, technology-facilitated anticorruption, digital oversight institutions, citizen scorecards, data-driven journalism, online deliberation and discourse, open government data ecosystems, public-private-people partnerships, public bidding on government contracts, and proactive release of government data.

The institutionalization of Digital Government innovations at the Engagement Stage leads to the emergence of new governance paradigms such as: Mobile Government, i.e. the use of mobile technologies to change the processes of governance or the interaction between users and government (World Bank, 2012) and to reach out to the whole population; Citizen Sourcing, i.e. citizens helping governments improve their situational awareness and influence their decisions and outcomes (Linders, 2012); Participatory Governance, i.e. “state-sanctioned institutional processes that allow citizens to exercise voice and vote, which then results in the implementation of public policies that produce some sort of changes in citizens’ lives” (Wampler & McNulty, 2011); Governing by Network which entails government “orchestrating networks of public, private, and nonprofit organizations to deliver the services that government once did itself”, away from “managing workers and providing services directly to citizens” (Goldsmith & Eggers, 2004) and includes Government Information Networks (Janowski, Pardo, & Davies, 2012); and Open Government, i.e. “the governing doctrine which holds that citizens have the right to access

the documents and proceedings of the government to allow for effective public oversight" (Wikipedia, 2015) among many other definitions (Longo, 2015).

Figure 11 depicts the Digital Government Stage Analysis Framework instantiated to the Engagement Stage.

DIGITAL TECHNOLOGIES
Social networks
Semantic web
Linked open data
Mashups
Sensor networks

PRESSURE ON GOVERNMENT
Reach out to citizens
Build situational awareness
Give voice to citizens
Engage private/voluntary sector
Facilitate citizen oversight

DG INSTITUTIONALIZATION
Mobile Government
Citizen Sourcing
Participatory Governance
Governing by Network
Open Government

DIGITAL GOVERNMENT INNOVATIONS	
Citizen consultation and ideation	Technology-facilitated anticorruption
Crowdsourcing and co-delivery	Digital oversight institutions
Electronic rule-making	Citizen scorecards
Social enterprise for public service	Data-driven journalism
Volunteering for public service	Online deliberation and discourse
Automated fraud detection	Open government data ecosystems
Participatory budgeting	Public-private-people partnerships
Digital collaborative accountability	Public bidding on government contracts
Expose and investigate services	Proactive release of government data

Figure 11: Instantiating Digital Government Stage Analysis Framework: Engagement Stage

7.2.4. Stage 4 – Contextualization or Policy-Driven Electronic Governance

Some of the pressures on government that gave rise to the Contextualization Stage include: responding to the changing needs and aspirations of the society, supporting self-governance for local communities to be able to govern themselves with no or little interference from government (Linders, 2012), ensuring equitable environment and prompt and fair delivery of justice for all actors in the economy and society, enabling the development and delivery of personalized public services through government-to-citizen or even citizen-to-citizen co-production, and stimulating the development of health, security, education, economy, trade, culture and other sectors through technology-enabled governance.

At the same time, a range of digital technologies became available to potentially help address such pressures such as: government as a platform, i.e. "a common core infrastructure of shared digital systems, technology and processes on which it's easy to build brilliant, user-centric government services" (Bracken, 2015); mobile platforms to provide mobile apps to mobile

devices; local big data (John Carlo Bertot, Butler, & Travis, 2014) and data mining for knowledge discovery; wearable devices and mobile health apps; ad-hoc networks; Internet of Things, etc.

Digital Government innovations employed at the Contextualization Stage to respond to such pressures using available digital technologies include (Eggers & Macmillan, 2015): concerning emergency – emergency assistance and community response grids; concerning regulation – outcome-based regulation and compliance automation; concerning the transport sector - sensor-based dynamic transport pricing, mobile collaborative transport and social transport apps; concerning the social services sector – public services for vulnerable groups, digital social innovation and outcome-based funding; concerning the health sector - healthy lifestyle interventions, monitoring of health and chronic diseases, remote and self-health monitoring, participatory medicine and digital preventive healthcare; and concerning policing – virtual incarceration, offender-targeted interventions, policing with wearable devices, crime mapping and crime hotspot monitoring.

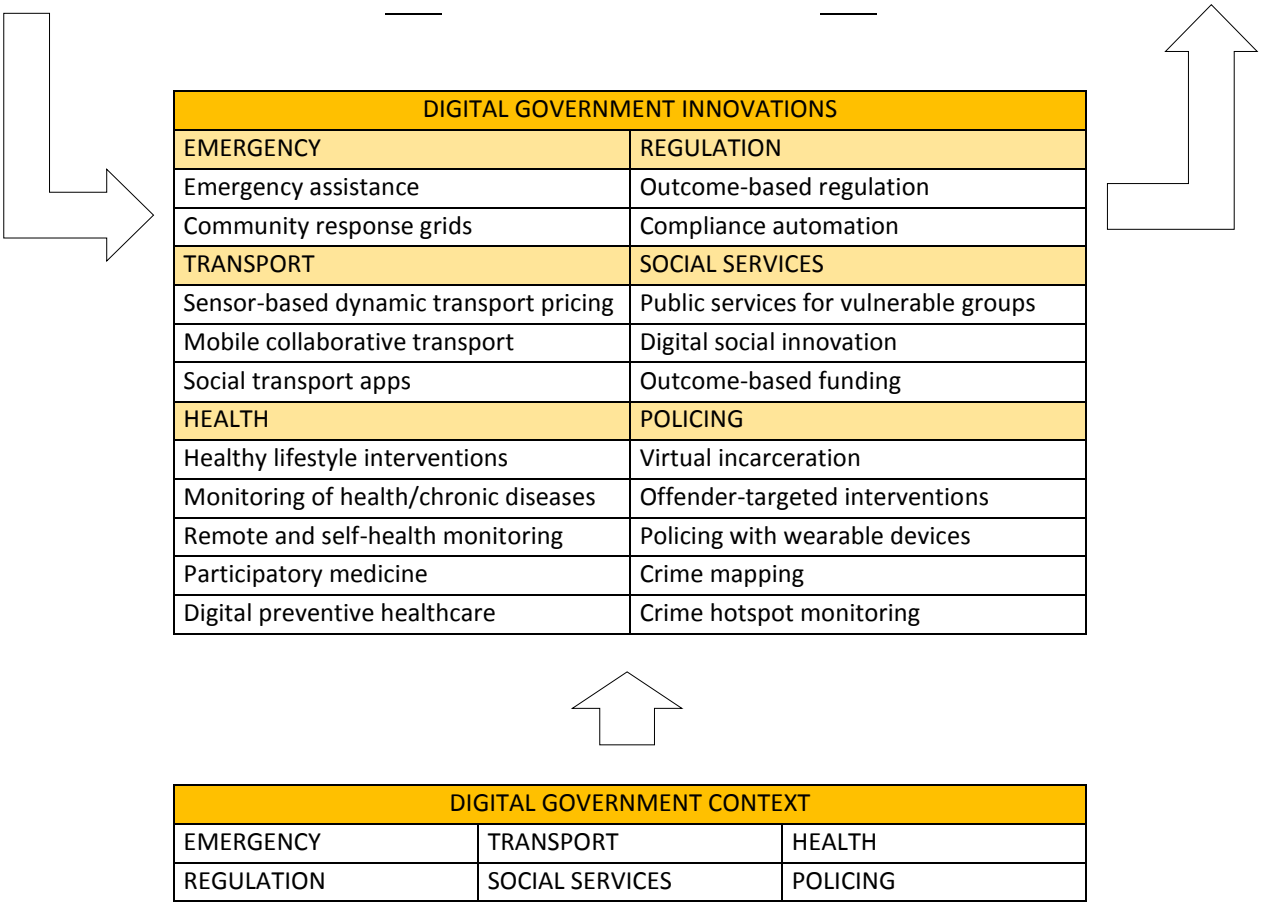
Institutionalization of Digital Government innovations at the Contextualization Stage leads to the emergence of new governance paradigms: Agile Government which refers to governments that is "flexible, able to adapt, and can respond quickly to meet citizens' needs" (ATKearney, 2014); Do It Yourself Government, i.e. government facilitating citizen self-organization and co-production to substitute for many of the traditional government functions (Linders, 2012); Regulatory Government refers to enhancing the regulatory role of government including regulatory quality, evaluation, impact, simplification, rule-making, etc. (Malyshev, 2005) and stepping back from the direct implementation role; Government as a Platform entails government making "its knowledge and IT infrastructure available to the public" in order to "help citizens improve their day-to-day productivity, decision-making, and well-being" (Linders, 2012), and focuses on government mobilizing and empowering stakeholders to stimulate collaboration and innovation, while facilitating experimentation and monitoring (Janssen & Estevez, 2013); and the vast area of Sectoral Digital Government, i.e. Digital Government applied to the needs of particular sectors. An example of the latter is Green Government, i.e. government showing leadership on the environment to the wider public sector, citizens and businesses, and setting and pursuing sustainability goals for its operations and procurement (UK Environmental Audit Committee, 2009).

Figure 12 depicts the Digital Government Stage Analysis Framework instantiated to the Contextualization Stage.

DIGITAL TECHNOLOGIES
Government as a platform
Mobile platforms
Ad hoc networks
Local big data, data mining
Wearable devices, health apps

PRESSURE ON GOVERNMENT
Respond to changing needs
Support self-governance
Ensure equitable environment
Enable personalized services
Stimulate sectoral development

DG INSTITUTIONALIZATION
Agile Government
Do It Yourself Government
Regulatory Government
Governance as a platform
Sectoral Digital Government



DIGITAL GOVERNMENT INNOVATIONS	
EMERGENCY	REGULATION
Emergency assistance	Outcome-based regulation
Community response grids	Compliance automation
TRANSPORT	SOCIAL SERVICES
Sensor-based dynamic transport pricing	Public services for vulnerable groups
Mobile collaborative transport	Digital social innovation
Social transport apps	Outcome-based funding
HEALTH	POLICING
Healthy lifestyle interventions	Virtual incarceration
Monitoring of health/chronic diseases	Offender-targeted interventions
Remote and self-health monitoring	Policing with wearable devices
Participatory medicine	Crime mapping
Digital preventive healthcare	Crime hotspot monitoring

DIGITAL GOVERNMENT CONTEXT		
EMERGENCY	TRANSPORT	HEALTH
REGULATION	SOCIAL SERVICES	POLICING

Figure 12: Instantiating Digital Government Stage Analysis Framework: Contextualization Stage

8. Conclusions

The paper has several findings. First, that Digital Government concept as researched and practiced over the past two decades continues to evolve. Second, that the evolution exhibits regular patterns that can be captured by the Digital Government Evolution Model and its four distinctive stages: Digitization or Technology in Government, Transformation or Electronic Government, Engagement or Electronic Governance and Contextualization or Policy-Driven Electronic Governance. Third, that the stages can be characterized by the combinations of three binary variables: whether government digitization acts upon existing government processes without changing them or is accompanied by government transformation; whether the transformation is internal to government or also affects the relationships between government and various non-government stakeholders; and whether the transformations depends on the national, local or sectoral government context where it is performed or is context-independent. Namely: all three variables return false for the Digitization stage, all three variables return true for the Contextualization stage, the first variable return true and the rest false for the Transformation stage, and the last variable returns false and the rest true for the Engagement stage. Fourth, that the presence of the four Digital Government Evolution states can be

confirmed by the analysis of articles published in Government Information Quarterly. Fifth, that the origins, mechanisms and consequences of different Digital Government Evolution stages can be explained by: examining why governments are under pressure, what relevant digital technologies are available, how governments address the pressures by innovating with such technologies, and how continued technology-enabled innovation becomes institutionalized government practice.

The findings have some limitations. First, the tension between the sharp logical characterization of different stages of the Digital Government Evolution Model and the fuzzy and complex nature of some Digital Government initiatives. Second, the subjectivity of the classification of the papers into stages; as some borderline cases may cover more than one stage, the classification only demonstrate generic developments. Third, lack of policy and practice-based evaluation of the Digital Government Evolution Model to complement research-based evaluation, and the selection of the research literature from just one journal source. Fourth, the selection of related work and relevant GIQ publications based on the explicit use of "Digital Government" and related terms against the increasing diffusion of digital technology into different government sectors through outside the "Digital Government" umbrella. Fifth, selective referencing for difference instances of the Digital Government Stage Analysis Framework, and lack of barriers to technology-enabled innovation in the framework.

While appealing for conceptual reasons, the known critique of the stage of growth models, i.e. "predictable patterns which exist in the growth of organizations and unfold as discrete time periods that result in discontinuity" is that the models "are often not empirically validated, do not transcend the level of individual organizations" and do not make explicit how the stages are derived (Klievink & Janssen, 2009). Unlike the stage of growth models, the Digital Government Evolution Model is not aimed at leading organizations toward higher stages of Digital Government maturity (micro level) but capturing de facto evolution of the area (macro level), with different stages of the evolution co-existing in time, and the earlier stages remaining the necessary and legitimate targets for new research and innovation. It is in this sense that we jointly use the terms "evolution" and "stage", although the former normally describes continuous and the latter discrete change. In addition, the Digital Government Stage Analysis Framework attempts to explain the origins, mechanisms and consequences of different stages of the evolution.

The research has several policy implications. The first is the growing internal complexity and increasing impact of Digital Government on its external environment, and the need to employ effective measures for controlling the complexity and managing the impact. The second is increasing context-specificity and specialization of Digital Government initiatives and the need to simultaneously rely on technological, organizational, socioeconomic and sectoral knowledge to ensure planning, implementation and evaluation of such initiatives. The third is the incremental nature of different stages of Digital Government Evolution, where capabilities required at one stage require capabilities built at earlier stages. The fourth is the decision chain through which Digital Government innovations deployed to address particular pressure on government is institutionalized over time and becomes part of regular government practice. The fifth is the

initial repository of Digital Government Innovations and related institutionalization efforts characteristics to different stages presented in the article.

The future work include conducting policy- and practice-based evaluation of the Digital Government Evolution Model to complement research-based evaluation as well as extending the research-based evaluation to cover more literature sources. Future work also includes comparing de facto progression captured by the Digital Government Evolution Model against progression by design captured by various Digital Government stage of growth models, and searching for a middle ground. Finally, as Digital Government Evolution is bound to continue, it will be fascinating to discover and explain new Digital Government Evolution patterns to emerge in the future, and how they are able to serve public policy needs in different national, local and sectoral contexts.

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